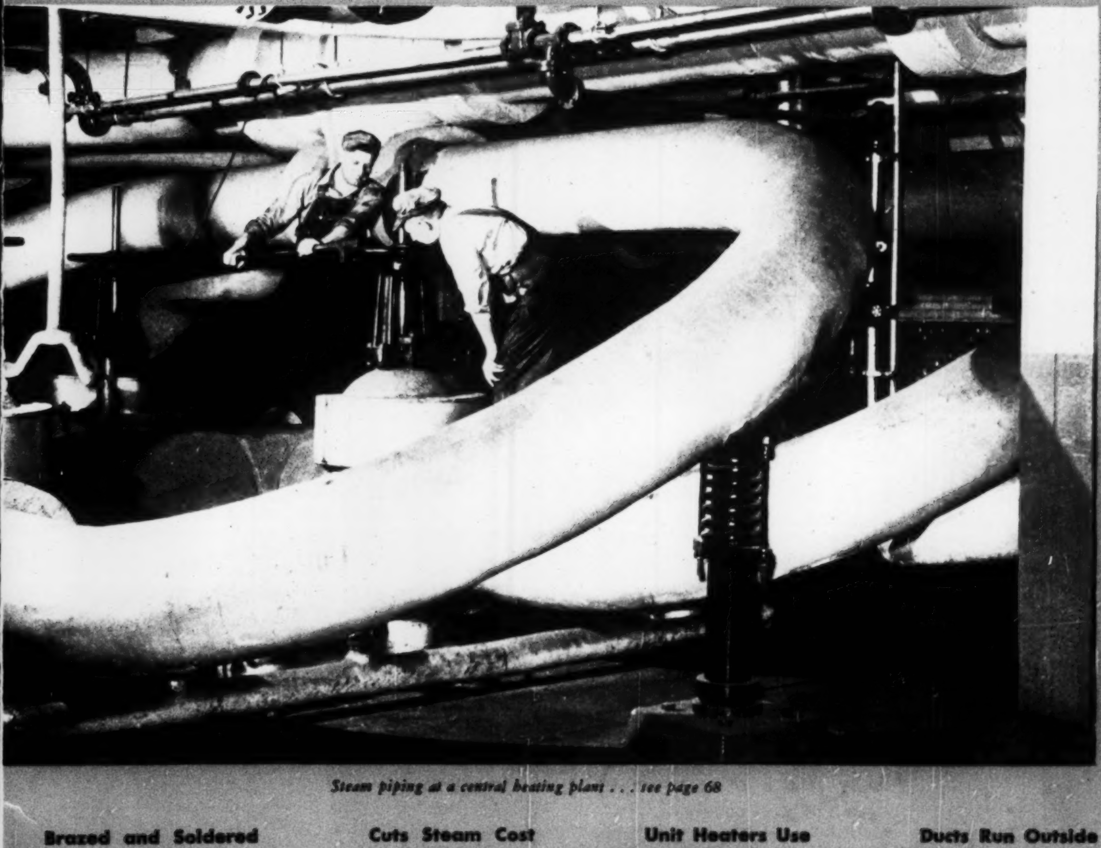
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

OCTOBER ★ 1950

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 107—Journal Section of the American Society of Heating and Ventilating Engineers



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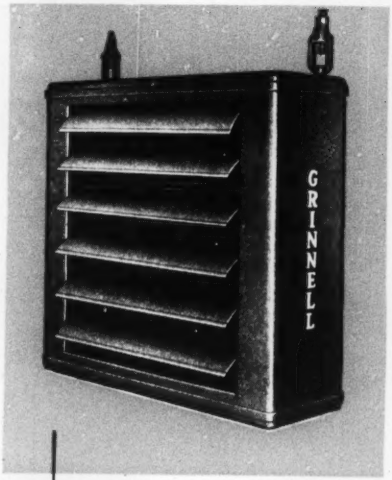
Keep heat and heating costs from "HITTING the CEILING"



THIS WINTER, why not see that you get *all* the heat you are paying for? Let Thermolier Unit Heaters bring both your heat—and your heating costs—down to a *reasonable* level.

HEATING COMFORT Thermolier Unit Heaters provide quick heating from a cold start. Desired temperatures are easily maintained within a close range. Heat is uniformly distributed in the working zone by forced air circulation. It is a very flexible system because different or changing heating requirements are easily satisfied by means of different models, a range of capacities, single—or two-speed motors and individual thermostatic controls.

LOW FIRST COST Thermolier Unit Heaters are so efficient and so compact that their heating capacity is often equivalent to the capacity of cast iron radiation or pipe coils of twice the cost. Additional savings are effected because the system requires a proportionately smaller amount of pipe, fittings and accessories.

ECONOMY OF OPERATION Heat is forced down to the working level . . . not banked uselessly at the ceiling level. Heat is turned on and off merely by throwing a switch either manually or automatically by simple thermostatic controls. The rapid response means that heat is furnished only when and where it is wanted . . . no heat is wasted.

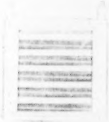
ADAPTABILITY TO EQUIPMENT AND FLOOR LAYOUT Thermolier Unit Heaters are widely used in industrial plants and warehouses, garages, stores and public buildings. The units and the simple piping are overhead where they do not interfere with arrangement of operating machinery or equipment and do not take up valuable floor or wall space. Units are easily relocated at any time to meet changes in layout.

THERMOLIER UNIT HEATERS HAVE IMPORTANT CONSTRUCTION ADVANTAGES The design of Thermolier Unit Heaters is the product of Grinnell Company's 100 years of heating experience. Heating experts like Thermolier's dependable operation, freedom from maintenance troubles and durability. Typical of its construction features is the patented internal cooling leg which permits the use of a plain thermostatic trap, the simplest, least expensive kind of a trap. Other features are built-in drainage, continuous rated capacity and provisions for expansion of U-tubes.

Get in touch with Grinnell or your local Thermolier distributor.

There is a type and capacity of Grinnell Thermolier for maximum heating results under every condition.

textile model


horizontal delivery

velocity nozzle

vertical delivery

GRINNELL

THERMOLIER UNIT HEATERS

Grinnell Company, Inc., Providence, R. I. Branches: Atlanta • Billings • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach
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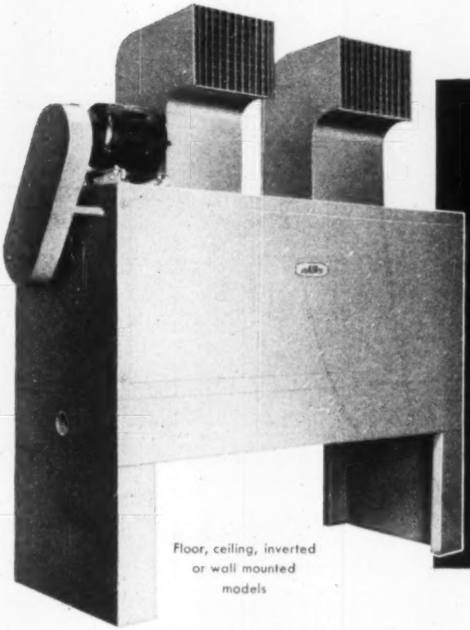


Floor, ceiling, inverted
or wall mounted
models

usAIRco's NEW BLOWER TYPE UNIT HEATERS

The new usAIRco Blower Type Unit Heater has all-around adaptability for industrial application in factories, warehouses and garages where large volumes of air must be heated and distributed.

As illustrated the Unit Heater includes blowers, coil and distribution cowls. Various accessories are available to meet additional requirements.

SECTIONAL ASSEMBLY—Units are built in sections which permit easy installation and maintenance.

BLOWER SECTION—One or two slow speed, forward curved, centrifugal blowers are used for high efficiency and quiet operation. Double blower units have single shaft with outside bearing mounts for easy lubrication and isolation from heat.

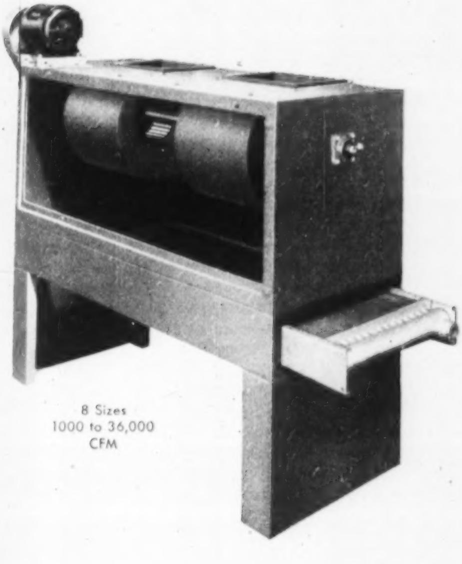
COIL SECTION—Constructed of heavy gauge, accurately formed steel, the coil section bolts to the blower cabinet. The coil is readily removed from either end of access panel. Coil section is symmetrical so coils can be turned end for end for convenience of erection and installation.

FACE AND BY-PASS DAMPER SECTION—A separate damper section is available for installation between blower and coil sections—external by-pass. Dampers can be manually or automatically controlled.

FILTER SECTION—Where required, sections with cleanable or throw away type filters are furnished.

HEATING COILS—Standard steam or steam distributing-tube coils may be provided in any one of five capacity series.

UNIVERSAL APPLICATION—Units can be used in any one of four positions for floor, ceiling inverted or wall mounting. Cowls may be furnished for proper air distribution.



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CFM

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Position

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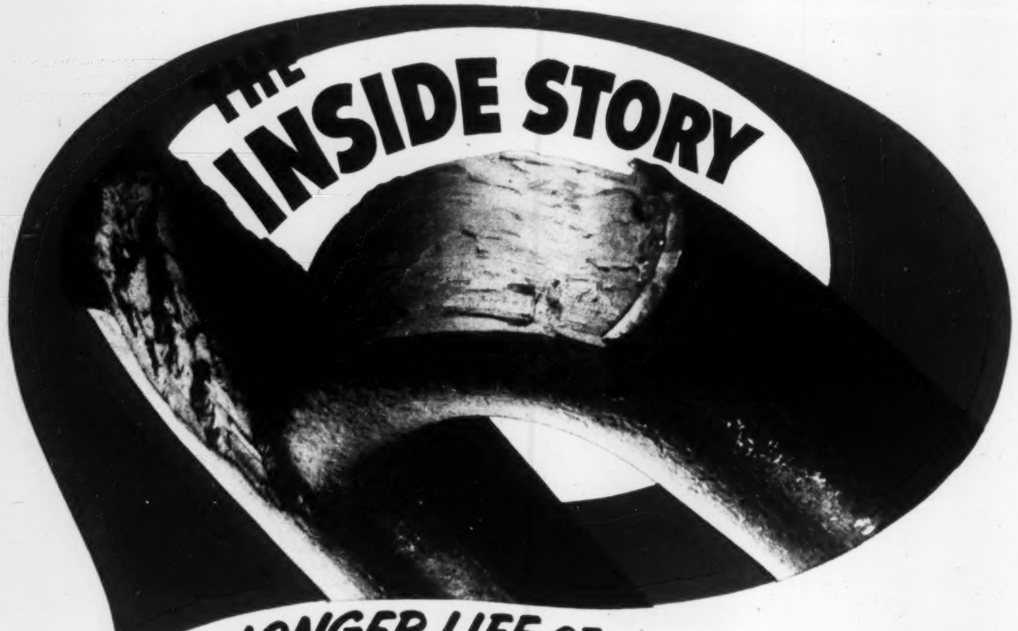
City Zone State

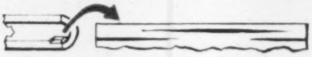


THE INSIDE STORY OF THE LONGER LIFE OF BYERS WROUGHT IRON

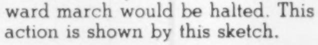
Every engineer will recognize this picture as a notch-fracture test specimen . . . and will appreciate the unusual physical properties suggested by the break.

The hickory-like fracture results from the unique structure of wrought iron. Tiny threads of glass-like silicate slag, 200,000 to 250,000 per square inch of section, are distributed through a matrix of high-purity iron. This fibrous structure, which might be compared to that of a stranded wire cable, equips wrought iron to withstand sudden shock, and to resist fatigue induced by continuing vibration.

Of even more importance in the average application is the *corrosion resistance* of wrought iron . . . which also comes directly from the unique structure and composition of the material. If a small section of wrought iron were placed under a microscope, a few of the multitude of silicate slag fibers would show up as in this sketch.



If corrosion attacks this specimen, it would first cover the entire surface . . . then concentrate at one point, and work inward. Soon it would encounter one of the slag fibers . . . and since this fiber is unaffected by corrosion, the inward march would be halted. This action is shown by this sketch.



Corrosion is now "detoured." It works right and left, until it comes to the end of the fiber, when it may start to work inward again. The process is repeated when the second line of defense is encountered. Pitting, and rapid penetration of the metal, is discouraged. Useful life is determined by how long it takes for corrosion to reduce the entire body of metal to its safe limit of thickness, rather than by how long it takes corrosion to perforate the wall at a few vulnerable points. The fibers also anchor the initial protective scale, which shields the underlying metal.

Every cost sheet today confirms the fact that the most expensive material you can use is that which must be replaced too soon—and too often. The extra service of wrought iron is helping tens of thousands of users to cut maintenance costs. We will welcome an opportunity to review your piping problem with you—and to recommend the places where wrought iron—on the basis of its past performance—can be profitably used. Ask for our booklet, "THE A B C'S OF WROUGHT IRON."

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, San Francisco. Export Division: New York, N. Y.

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Heating Piping & Air Conditioning

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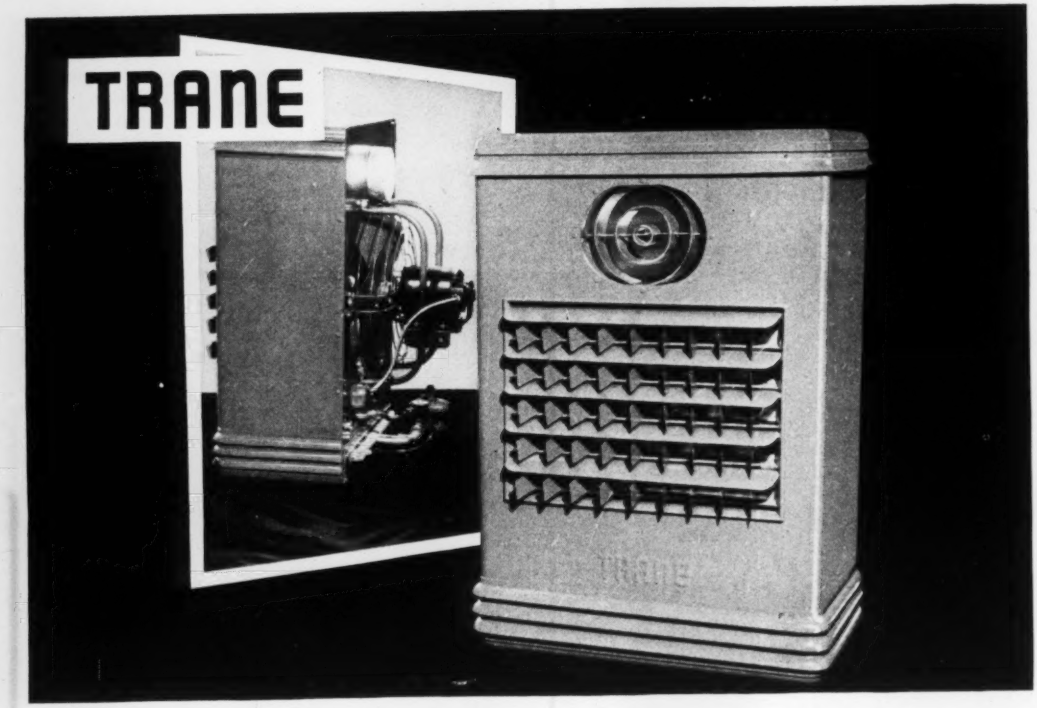

New Gas Unit Heater — Built Like a Boiler

They're new, they're attractive, they're built like a boiler. The complete new line of Trane Gas Unit Heaters. Designed to provide the best in heating comfort quickly, safely and economically. They offer the ideal solution to commercial and industrial heating problems. Check these important features:

The built-like-a-boiler heat exchanger. Staggered steel heating tubes, accurately sized for easy air passage, are rolled into extra strong end sheets, boiler tube style. They are then permanently bonded with a beaded and flanged connection. This insures maximum heat transfer and a lifetime of leakproof operation.

New type burner assembly. Sturdy one-piece cast iron burner eliminates warping, banishes leaks. Engineered for convenience, the burners, mixing tubes, pilot light, and controls are arranged in a compact, easy-to-handle drawer assembly. Ideal for quick, easy inspection.

A complete line. Seven sizes of ruggedly constructed units have capacities ranging from 50,000 to 210,000 Btu. This permits selection of exactly the right unit to fit the requirements of the job. Every Trane Gas-Fired unit is adaptable for all types of gases — natural, manufactured, mixed and liquefied petroleum. Adjustable Louver-Fin Diffuser (shown on unit above) optional.

For complete Trane Gas Unit Heater information write to the Trane representative in your area or to the main office.

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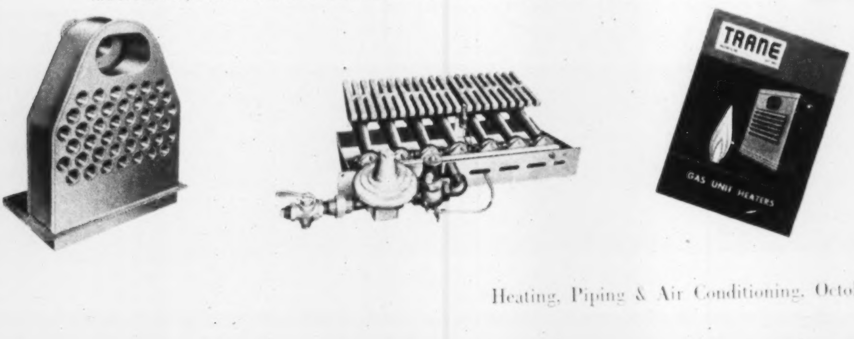
The built-like-a-boiler heat exchanger (left) and the compact heat generator assembly (center) are but two of the many features of the new Trane Gas Unit Heater. Bulletin DS-347 contains detailed information.



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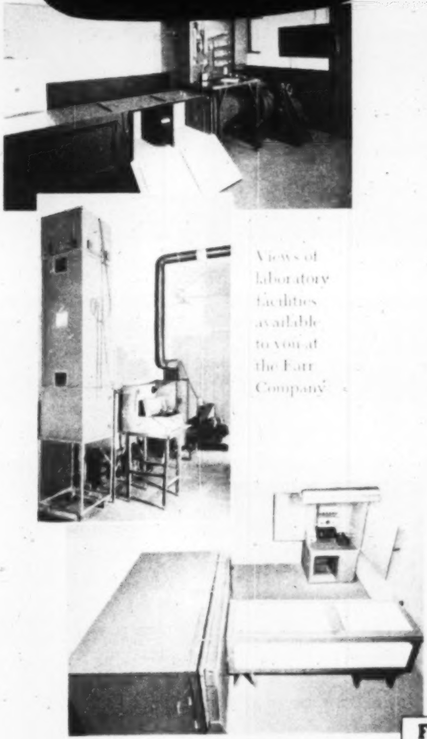

Views of laboratory facilities available to you at the Farr Company

Farr Company Engineers offer complete laboratory services to bring you better air filtration . . .

Your air conditioning system deserves the best in air filters and standard FAR-AIR* filters will meet most of your requirements. However, if you are faced with unusual dust conditions, Farr Company's well-equipped laboratory will help you select the proper type of filter to meet your particular problem.

These laboratory facilities are also used to constantly improve the FAR-AIR line to assure you of getting the very best air filtration when you install FAR-AIR products.

Send in your air filtering problem today or write for information on the complete FAR-AIR line.

Typical users of FAR-AIR equipment include:

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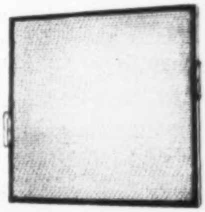

*Trade Mark Reg.

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"Better by Farr"

FARR COMPANY *Manufacturing Engineers*

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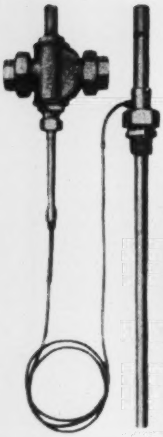
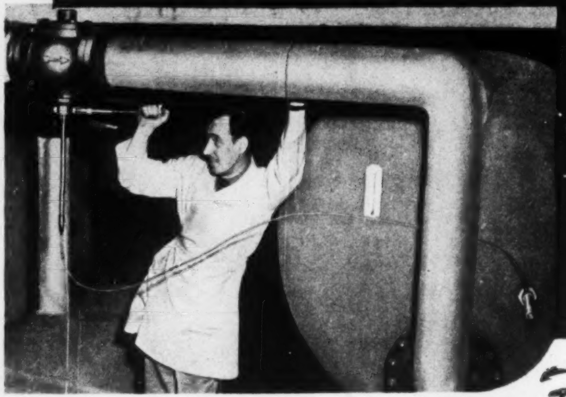
Hold Everything!





HOT
WATER

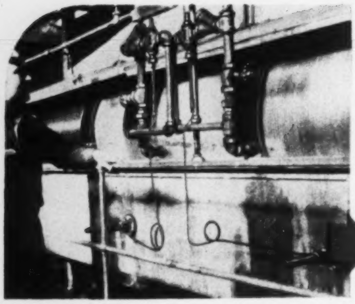
AT CORRECT TEMPERATURES WITH SARCO

TR-21

REGULATORS

For 20 Years

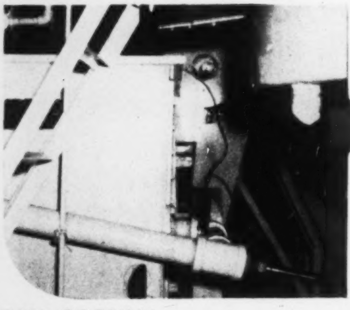
The hot water in this large hotel was held at exactly the right temperature with the Sarco TR-21 regulator illustrated. During all this time there were no complaints because the water was too hot or too cold; and, of course, no heat wasted. Recently a wrench was put on the regulator for the first time and a few dollars worth of new parts installed. Now they look forward to twenty more years of service and saving with Sarco.



PROCESS TANKS

Better Production

No process requires closer regulation than the various tanks in an automatic plating machine. In the plant illustrated, everything is automatic because all temperatures are controlled to within a few degrees by Sarco. The owner reports greatly increased production with practically no rejects and a considerable reduction in the amount of steam used.



CAN COOLING

Production Speed-Ups

Here is a can cooling operation which moves warm cans of fruit through a cooler on a conveyor. When operated by hand, water was wasted to be sure the temperature was safe. Even then, cans sometimes came out too warm and food was wasted. Now, with the same TR-21 regulator shown above, less water is used and no food lost. Ask for Sarco Catalog No. 600.

320

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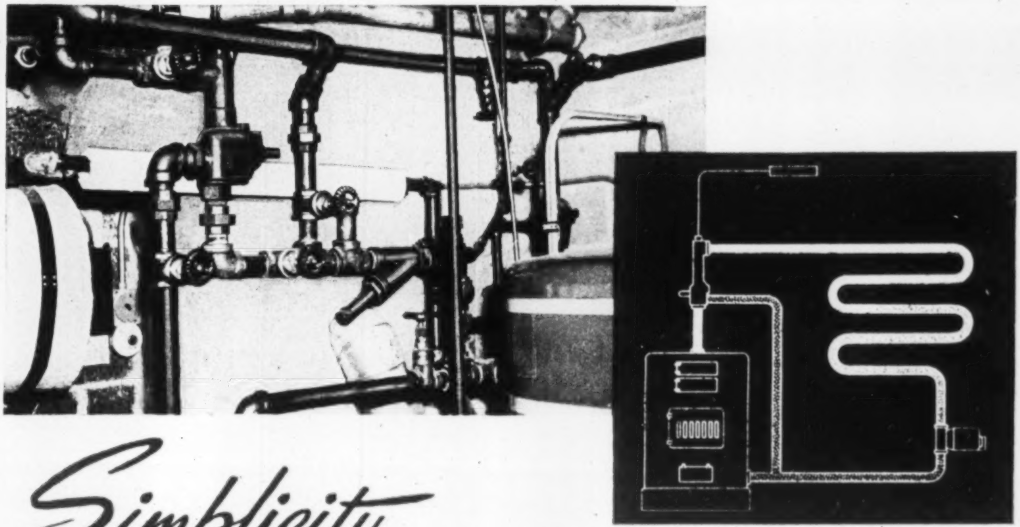

Simplicity is Obvious — IN PLANNING, SELLING AND INSTALLING

SARCOTHERM HOT WATER CONTROL

Sarcotherm has made great strides in the past five years, thanks largely to architects and heating men who have appreciated its simplicity, flexibility and low cost. The designer can figure on lower boiler temperatures, even comfort for all outside conditions, zone control, split systems, night set-back—all with the same simple three way valve that comes in a package called "Sarcotherm." He can compete successfully on any hot water job including the large apartments where engineers sharpen pencils on the fuel costs as well as the first cost. He can help builders compete on homes, when price is involved, or when the owner wants evidence from other users that Sarcotherm is the ideal for comfort, in all seasons.

And finally, because each Sarcotherm job leads to others, the volume of business grows, and since servicing costs of this simple, reliable system are low, the profits go up. Besides the catalog shown below, which is primarily for the user, Sarcotherm provides mail pieces, technical data and other material, imprinted as desired.

Sarcotherm

THERE IS A SARCOTHERM MAN NEAR YOU. WHY NOT CALL HIM UP NOW?

Sarcotherm

15

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...permanently
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IN THE REFRIGERATION FIELD,

the surest and safest way to prevent fittings leaks is to install W-S Double-diamond Screw End and Socket Weld Forged Steel Fittings.

Designs are carefully engineered. Basic Materials are selected from a wide choice of carbon, stainless and alloy steels. Drop forging and precision machining makes them light in weight, assures accuracy of finish, and, all are instrument inspected for perfection of threads, sockets, angles and concentricity. Investigate them today.

Write for Bulletin A3-50. For information on stainless and alloy steel fittings ask for Bulletin S-1.

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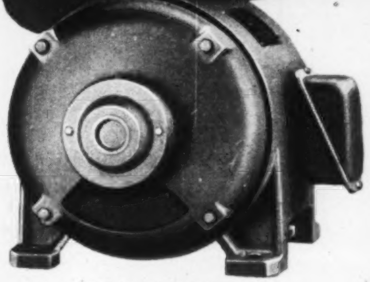
"Safety-Circle"
Drip-Proof
MOTORS

TOP and SIDES PROTECTED



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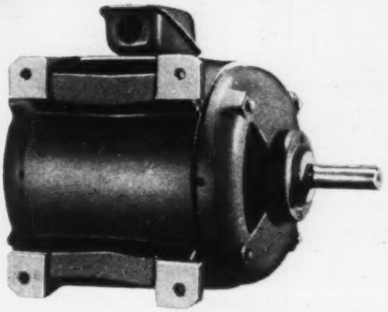

BOTTOM PROTECTED

Get All-Around Motor Protection with SAFETY-CIRCLE

THAT SOLID CAST IRON FRAME protects *Safety-Circle* working parts against physical damage from every angle. The completely enclosed bottom provides extra protection and extra strength. End brackets are drip-proof at no premium.

Because the frame is cast iron, it is resistant to rust and corrosion. It withstands physical abuse and will not distort.

Protected Inside, Too

Safety-Circle protects against internal breakdown with multiple-dipped and baked stator and die-cast aluminum rotor. *Ball bearings are factory-lubricated and need no attention for years.* Wide open internal construction and large fans keep temperatures well within rated limits.

Don't be satisfied with a motor that gives you less than full protection. Insist on the extra protection of *Safety-Circle.*

For complete details on *Safety-Circle* advantages, see your A-C Authorized Dealer, Sales Office, or write for Bulletin 51B6210B. Sizes from 1 to 20 hp, 326 frames and smaller.

A-3145

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TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

WORTHINGTON AIR CONDITIONING REPORT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

Specialists in air conditioning and refrigeration for more than 50 years

We're Part of the HOSPITALITY at the Westward Ho

If ever the name of a hotel suggested an invigorating atmosphere, it's the spectacular Westward Ho in Phoenix.

Internationally famous as a resort hotel, the Westward Ho gives its guests the year-'round comfort of air conditioning, furnished by Worthington equipment.

Five years ago, when the hotel wished to expand its air conditioning, a Worthington centrifugal compressor was installed, with the original unit put aside for stand-by service.

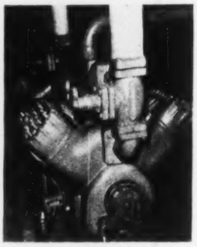
Last year, an annex to the hotel was built, and Worthington equipment was again selected: two Freon reciprocating compressors and one condenser.

Distributor: Frank Harmonson Co., Phoenix.

Westward Ho is Phoenix' largest hotel. It is completely Worthington-conditioned.

La Mina Room, one of the several dining rooms in the Westward Ho.

Cool, comfortable air, Worthington-supplied, adds to the charm of this typical suite in the Westward Ho annex.



Two Worthington Freon-12 6HF4 Compressors installed in the new annex.

Now They Trade in Comfort on the New Orleans Exchange

New Orleans Cotton Exchange—completely air-conditioned by Worthington.

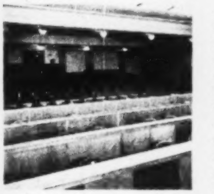
Consulting Engineers—Leo S. Weil and Walter B. Moses.

Contractor—Mayer Godchaux

During its nearly 80 years, The New Orleans Cotton Exchange has undoubtedly observed many scenes of feverish trading, but since 1948 the air, at least, has maintained a moderate temperature.

Worthington centrifugal refrigeration makes the difference. The Worthington system has a capacity to cool 420 gpm of water from 55.6 F to 46 F when supplied with 545 gpm of condensed water at a maximum of 87 F. Capacity rating for the entire system is 160 tons.

Worthington Makes a Hit in Sangamo's Auditorium



Auditorium in plant of Sangamo Electric Co., a leading manufacturer of electric measuring and control equipment, Springfield, Illinois.

The modern auditorium built by Sangamo Electric Corporation to be used as a meeting place for employee training courses, sales conferences, and employee organizations, provides the year-'round comfort of Worthington air conditioning.

The equipment, installed by Henson Robinson Co. of Springfield, Ill., includes a 3HF6 Freon-12 compressor, an AVY air conditioning unit, and an ECZ evaporative condenser. The system is rated at 15 tons and handles 4500 cfm. 95% of the condenser water is saved for re-use.

Here's how the system operates. A single off-on wall switch controls the entire system, with inter-locks for proper sequence of operation. A room-type cooling thermostat actuates a solenoid valve in the Freon liquid line. A heating thermostat actuates a modulating-type steam valve and modulating-type motor connected to air conditioning face and by-pass damper.

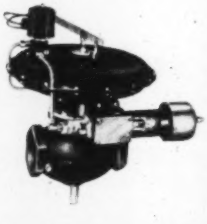
A manual modulating-type control and motor secure the desired mixture of fresh and recirculated air entering the unit (maximum 3000 cfm). Automatic change-over from heating to cooling cycle, or vice versa, is provided.

In order to prevent freezing of water in the evaporative condenser, located in the equipment room, a duct arrangement with temperature controller and damper motor was installed. This insures trouble-free operation when outside temperature falls below 35 F, since the evaporative condenser supply air is taken from the equipment room.

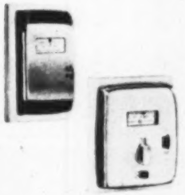
WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

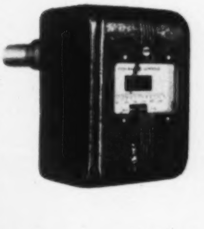
A complete line . . . in which *all* the vital components are *made*, not just assembled by Worthington. For more worth with Worthington, see your nearby Worthington distributor (consult Classified Telephone Directory).



B-55 G Governor Type Valve



T-70 and T-70T Thermostats



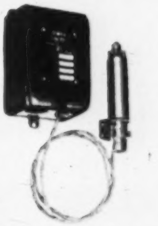
L-32 Immersion Thermostat

5B Interval, On-Off Time Switch

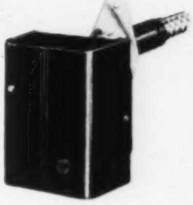
for better HEAT CONTROL check

GENERAL CONTROLS

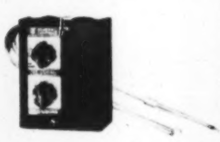
Whatever the *control* problem... whether it's *product* control...or *process* control...in any application where a higher level of operating performance is the goal...*automatic* controls more often than not form the solution...and in the field of automatic controls...there's certain to be a General Control that can be relied upon to do a better job. That's why more and more of the leaders in American Industry are joining in the big swing to General Controls...that's why there are so many new voices in the rising chant that, "for the best in automatic control, it's General Controls."



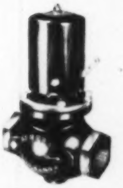
A-100 Thermopilot Relay



R-99 Stack Switch

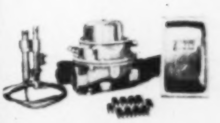


L-54 Solid Charge Combination Fan and Limit Control



Hydramotor G 1-7

T-30 Package Set



BX-69 Package Set

SIMPLIFIED TWO WIRE CONTROLS ARE BETTER

See us at the A.G.A. Convention
— GAMA Exhibition
in Atlantic City, Oct. 2-6.

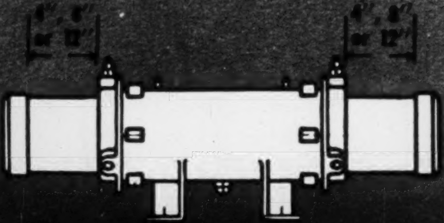
GENERAL CONTROLS

801 Allen Avenue Glendale 1, California

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cincinnati 2, Cleveland 15, Dallas 1, Denver 4, Detroit 21, Glendale 1, Houston 6, Kansas City 2, Minneapolis 2, Newark 6, New York 17, Philadelphia 23, Pittsburgh 22, St. Louis 12, San Francisco 7, Seattle 1, Tulsa 6. DISTRIBUTORS IN PRINCIPAL CITIES

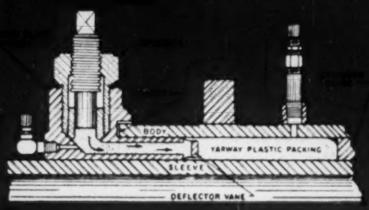
YOU NEED FEWER JOINTS



With Yarway Gun-Pakt slip-type expansion joints you need *fewer* joints than with other types, because each sliding sleeve has a traverse of 4″, 8″ or 12″ . . . maximum expansion being 24″ for a double-end joint.

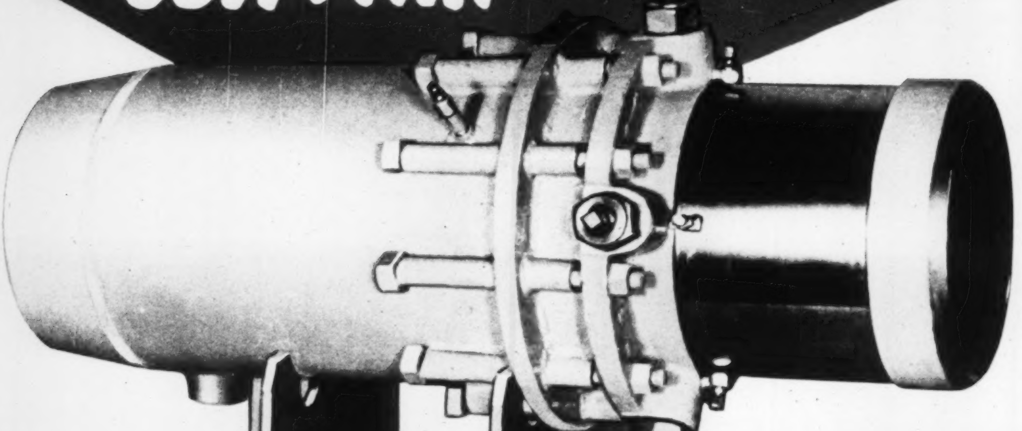
For example, one single-end Yarway Gun-Pakt joint with an 8″ traverse is all that is needed for a 200 ft. run of steel pipe carrying saturated steam at 250 psi.

AND LESS MAINTENANCE



No need for shutdowns. Yarway Gun-Pakt Joints are serviced under full steam pressure. Just insert a plug of Yarway plastic packing, twist a wrench and the job is done. Maintenance and production manhours are saved!

with GUN-PAKT expansion joints



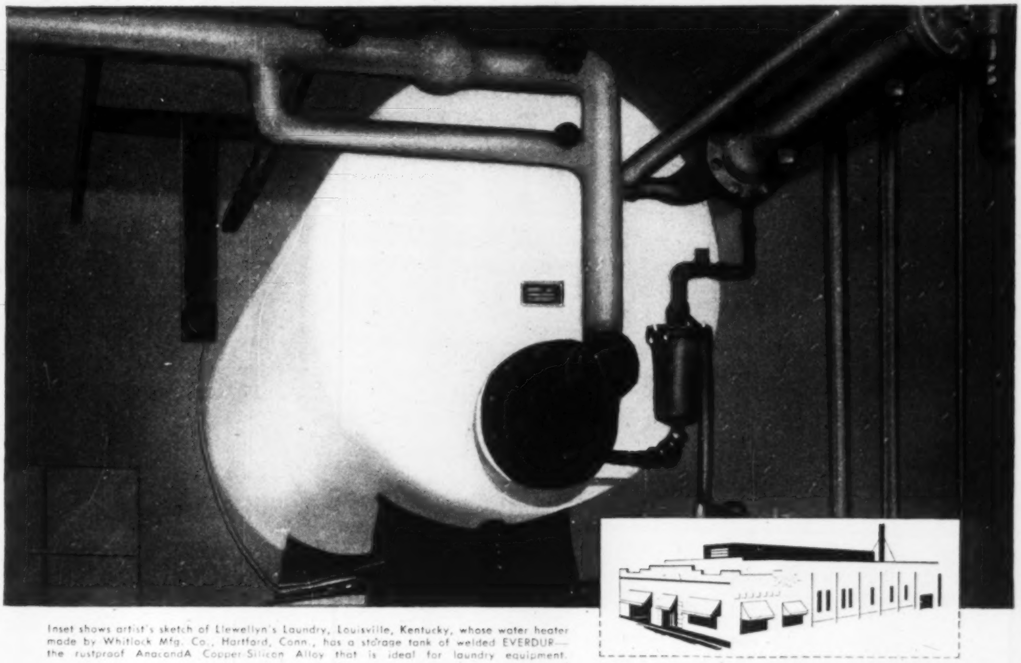
Leading central heating stations, institutions and industrial plants use and *recommend* Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Ave., Phila. 18, Pa.

YARWAY GUN-PAKT EXPANSION JOINT

water **can't rust** a heater made of

...and how stubbornly it resists corrosion!



Inset shows artist's sketch of Llewellyn's Laundry, Louisville, Kentucky, whose water heater made by Whitlock Mfg. Co., Hartford, Conn., has a storage tank of welded EVERDUR—the rustproof AnacondA Copper-Silicon Alloy that is ideal for laundry equipment.

"At no time have we ever had a trace of rust or other corrosion," says Mr. E. A. Mall, President of Llewellyn's Laundry, Inc., Louisville, Ky., regarding his Whitlock Everdur Type K Storage Water Heater.

Where corrosion resistance counts—consider Everdur

THE SAME OPINION IS UNANIMOUS with users of Everdur* heaters in laundries from coast to coast.

EVERDUR IS TOUGH—AND STRONG, TOO, as well as easy to fabricate by all the usual methods—a combination made to order for laundry heater service.

WANT TO KNOW MORE about this tough, strong, rustproof metal? If so, write for our Publication E-13. The American Brass Company, Waterbury 20, Connecticut. In Canada, Anaconda American Brass Ltd., New Toronto, Ontario.

®

*Reg. U. S. Pat. Off.

COPPER—SILICON ALLOYS

No other air handling unit CAN MATCH ALL THESE

Westinghouse Air Handling Units have rolled up new performance records under exacting conditions in the field. Superior, rugged construction and sound engineering have brought them wide acceptance in a short time. What's behind this record . . .

1. CONSTRUCTION

Sectionalized casings have welded, gusseted structural angle frames and removable panels. Fan and coil section panels have half-inch rigid internal insulation. Rotating parts—wheels, shafts and bearings—are heavy and rugged. Result—Non-distortion in shipping, easier assembly, smooth operation, better appearance, and lower maintenance costs.

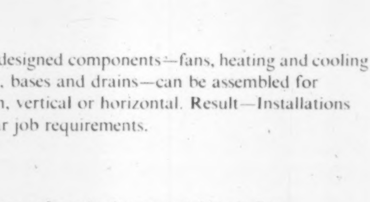
2. FLEXIBILITY

Westinghouse sectionally-designed components—fans, heating and cooling coils, filters, mixing boxes, bases and drains—can be assembled for any air handling operation, vertical or horizontal. Result—Installations "tailor-made" to particular job requirements.

3. PERFORMANCE

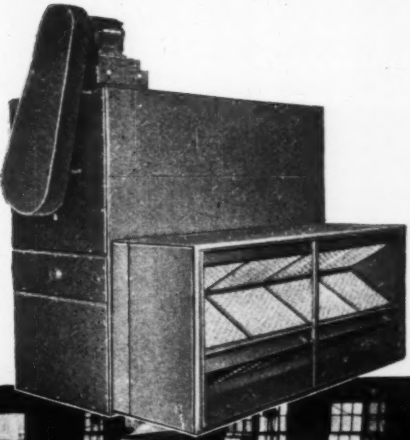
Backwardly inclined Silentvane fan wheels mean stable air flow and silent operation. Non-overloading horsepower and steep, stable pressure characteristics eliminate pulsing and surging. Result—Long, trouble-free service.

Behind these important features is the UNDIVIDED RESPONSIBILITY of Westinghouse for *every* major part. No other manufacturer today offers this "plus" value. For complete information on Westinghouse Air Handling Units—Type AH (Horizontal) or Type AV (Vertical)—write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

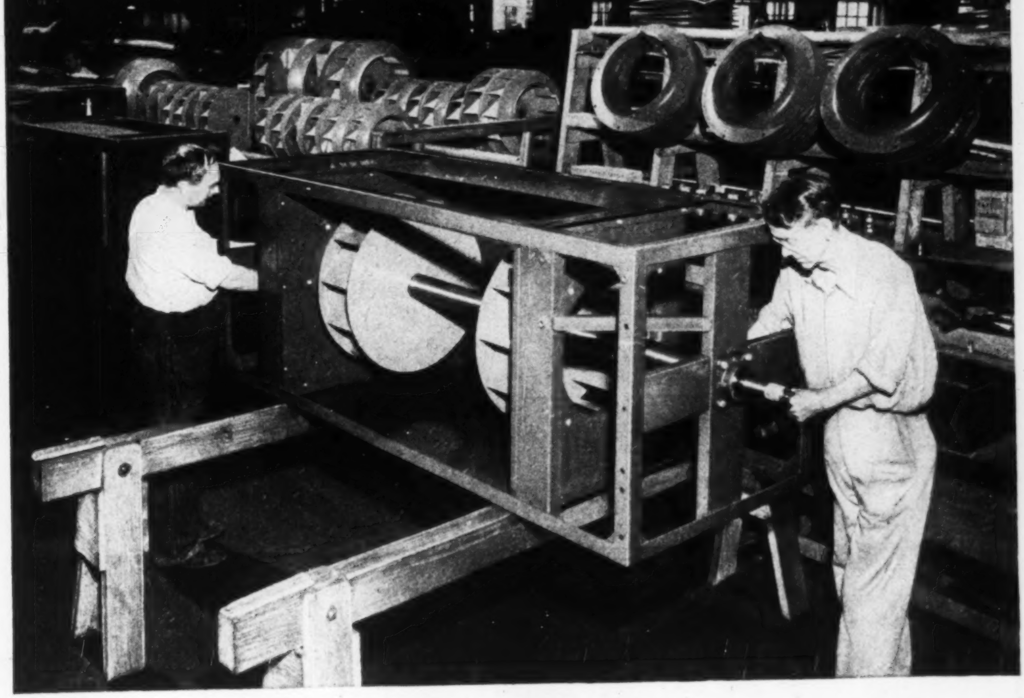


AH Unit

FEATURES



AV Unit



AH fan section being assembled

YOU CAN BE **SURE**...IF IT'S

Westinghouse

J-80191A

demand

DETROIT CERTIFIED CONTROLS

V-579 "Bi-flex" Gas Valve

- ★ Quiet operation—no click, no hum
- ★ Rugged, compact design—easy to service
- ★ Inexpensive
- ★ Adaptable to all gases
- ★ "Bi-flex" motor operated—low voltage
- ★ Temperature and voltage compensation
- ★ Snap action opening and positive closing
- ★ ½ inch to 1¼ inch sizes

New Value for Users—New Profits for You

From the Industry's Ablest Builder of Quality Controls!

The easiest thing in the world to sell is a good job at a low cost, and that's exactly what you can count on doing when you sell DETROIT Certified Controls. Why? Because DETROIT Controls are designed and built to fill your customers' needs—to give real economy and reliability through years of trouble-free service. And DETROIT'S new V-579 "Bi-flex" Gas Valve is no exception. Loaded with sales appeal, the new V-579 gives users, at low cost, an exclusive combination of outstanding features which provide new standards for the efficient and quiet operation of modern gas burning equipment. So insist that your source of supply furnish DETROIT Certified Controls with all your heating equipment—it will mean new value for your customers and assure new profits for you.

Write for Bulletin No. 229

No. 411 Thermostat—A sensitive and accurate *Timed Cycling* thermostat for all types of heating systems. Provides close control of room temperature. Attractively styled, easily installed and adjusted. Write for Bulletin No. 193 and Form No. 1545.

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5900 TRUMBULL AVE., DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION
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DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

Serving home and industry AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Pennsylvania
Also "Goes For"
KEWANEE
FIREBOX BOILER

KEWANEE
STEEL BOILERS

BUTLER SENIOR HIGH SCHOOL, Butler, Penna.
F. J. Firsching, Engineer
Harry Dougherty & Son, Inc., Heating Contractor
Installed are 3 Stoker-Fired No. 5189 Kewanee Welded Steel boilers.

Pittsburgh is the home of steel. And with the men in that great Keystone State who know steel best . . . it is significant that Kewanee Steel Boilers are first choice for heating their modern schools, hospitals, office buildings, etc.

Illustrated above is the boiler room of the Butler Senior High School, Butler, Penna., typical of the many fine installations where Kewanee Boilers are on the job throughout the nation.

In addition to providing 26,229,000 Btu or 109,290 sq ft of steam radiation, each Kewanee Boiler offers the important advantage of a generous reserve capacity for periods of unusual demand or for added requirements.

KEWANEE BOILER CORPORATION

BOILERMAKERS 80 YEARS KEWANEE, ILLINOIS
Branches in 60 Cities — Eastern District Office: 40 West 40th Street, New York City 18
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Serving home and industry

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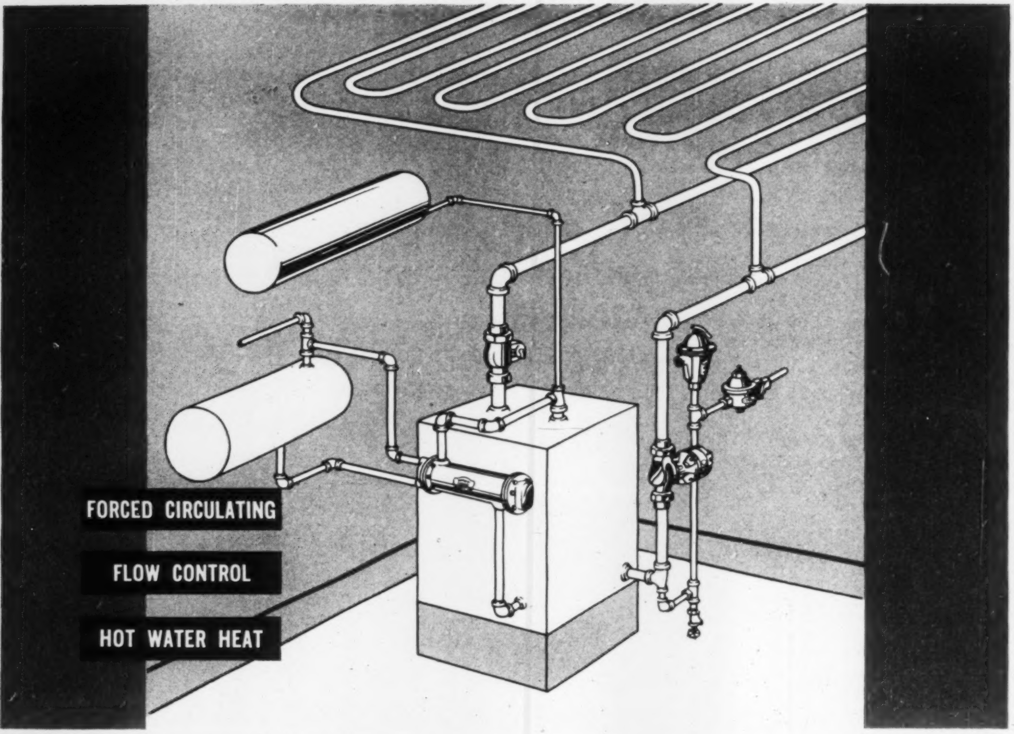
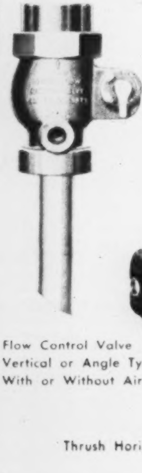
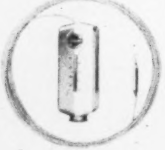


Thrush Radiant Heat

quiet, efficient low cost forced hot water circulation

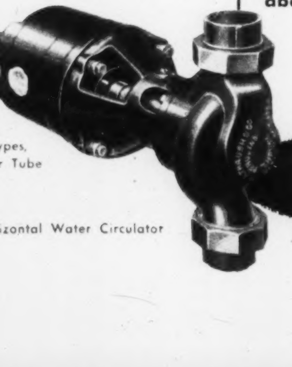


Flow Control Valve
Vertical or Angle Types,
With or Without Air Tube



No. 201
Radiant Heat Control

GIVE YOUR customers the finest, most efficent Radiant Heat . . . Hot Water with Forced Circulating Thrush Flow Control System. It provides uniform heating without continuous Circulator operation. Maintains constant flow of radiant heat under all weather conditions. Summer-winter domestic hot water for kitchen, laundry and bath is provided automatically. Get our booklet giving the complete story of Thrush Radiant Hot Water Heat. Ask your wholesaler more about it or address Department E-10.



Thrush Horizontal Water Circulator

leading name in

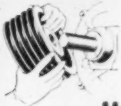
**H. A.
THRUSH
AND COMPANY**

**HOT WATER
CONTROLS**

PERU, INDIANA

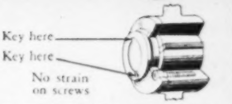
TEXROPE
Greatest Name in V-Belt Drives

4 BIG ADVANTAGES!



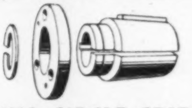
ONE PIECE MOUNTING

Bushing and sheave go on together. One motion mounting. Alignment is easier. Sheave is on right first time.



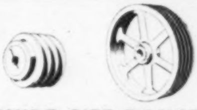
POSITIVE DRIVE

Bushing is keyed to both shaft and sheave. No slipping. No sheared screws. No jammed bushings from bent screws.



FULL CIRCLE GRIP

Bushing split full length with separate collar. Grips shaft full length around full diameter. No forcing or distortion. Grip easily broken. No hammering.



WIDE SIZE RANGE

Magic Grip sheaves are available from 3" pitch diameter up. Style NC bushing for smaller sizes and Style C bushing for larger sizes.

MAGIC GRIP SHEAVE

You can mount a *Magic Grip* sheave faster than any other sheave you can buy . . . and demount it just as fast. When you mount a *Magic Grip* sheave it runs true. It will not slip or jam. It always comes off easily.

Even if you don't change sheaves often, you should have *Magic Grip* sheaves on every drive to eliminate the possibility of shaft and bearing damage when ordinary sheaves are hammered or pried on or off.

WIDEST V-BELT LINE

Get everything you need for your V-belt drives from one reliable source. *Texrope* offers the broadest line of V-belts, standard and variable speed sheaves and speed changers in the industry. And you also get the extra engineering skill that comes from having more industrial V-belt installations than any other manufacturer.

Get your copy of the 144 page *Texrope* Pre-Engineered Drive Manual from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

A-3022

ALLIS-CHALMERS, 1171A SO. 70 ST.
MILWAUKEE, WIS.

Sold . . .
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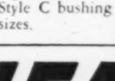
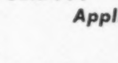
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters, push button stations and components for complete control systems.

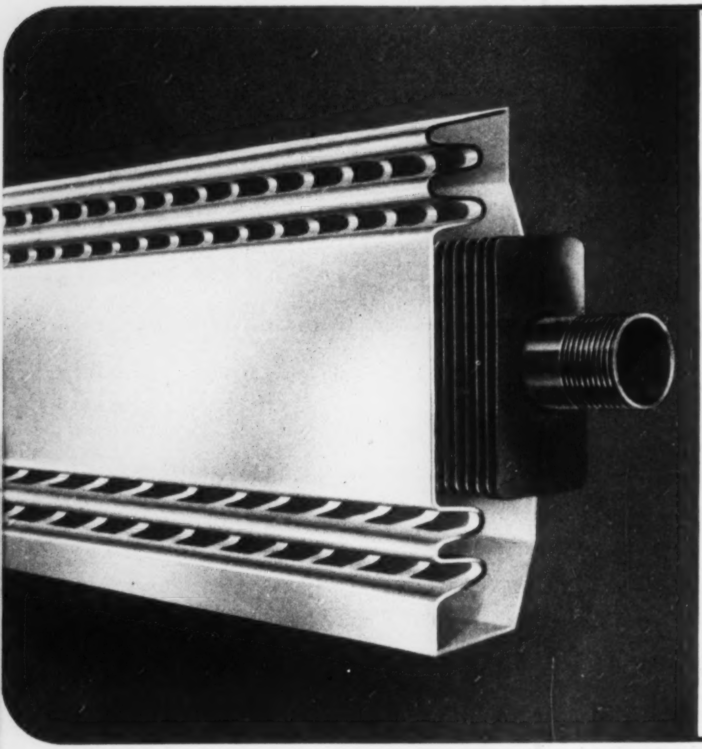


PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

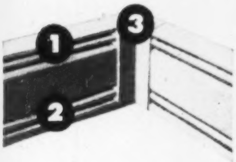
Texrope and *Magic Grip* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

dunham baseboard heating



other performance-proved points you'll want to know about



1. Unique Design of front section guides heated air away from walls, minimizes smudging.

2. Flush-with-Floor bumper permits wall-to-wall carpeting, presents finished appearance, speeds room cleaning.

3. No Pipe Fittings visible. Door and Finishing Caps conceal all piping, assure neater looking installation.

engineered up to performance not down to price!

Sure, price is important—but not more so than *performance*. After all, your customers live with—and judge you by—the *performance* record of the products you sell and install.

And there's where Dunham Baseboard Radiation plays right into your hands.

Your customers will like the fact that Dunham's method of mechanically attaching fins to pipe eliminates solder bond, provides greater heating surface, speeds heat transfer. And they'll find Dunham's individual room heat control damper both a convenience and an economy.

You'll like the fact that Dunham Baseboard is easy to install in any type of building . . . *old as well as new*. For example, in existing masonry construction, Dunham Baseboard can be installed without recessing into plaster.

Send For Free Booklet No. 639-D2

Contains complete information . . . including capacity tables, installation instructions for various types of applications, design details and typical specification sheets. Write for your free copy.

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C. A. DUNHAM COMPANY
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heating systems and equipment

Vari-Vac Differential Heating • Fin-Vector Radiation • Convector Radiation
Vacuum Pumps Condensation Pumps • Horizontal Heaters • Vertical Heaters • Cabinet Heaters Traps Valves

your Spang
CW
distributor believes...

That good service pays

SPANG
C W
PIPE

Your Spang CW Pipe Distributor makes your problems his when you call him. He knows that good service means satisfied, lasting customers. And he's more than willing to go out of his way to see that you get prompt, efficient service in emergencies.

He also knows that it pays to handle products of fine quality. That's why he stocks and recommends Spang CW Pipe. He knows that Spang CW gives long, trouble-free service. One of the reasons why this is true is because of the final finishing and descaling operations in its manufacture. This assures a smooth, scale-free inside surface that minimizes dangerous and costly valve clogging.

During these days of unprecedented demand, it's sometimes difficult for your Spang Distributor to fill your orders as quickly as he would like. But you can depend on him to render the best possible service in face of some rather difficult conditions.

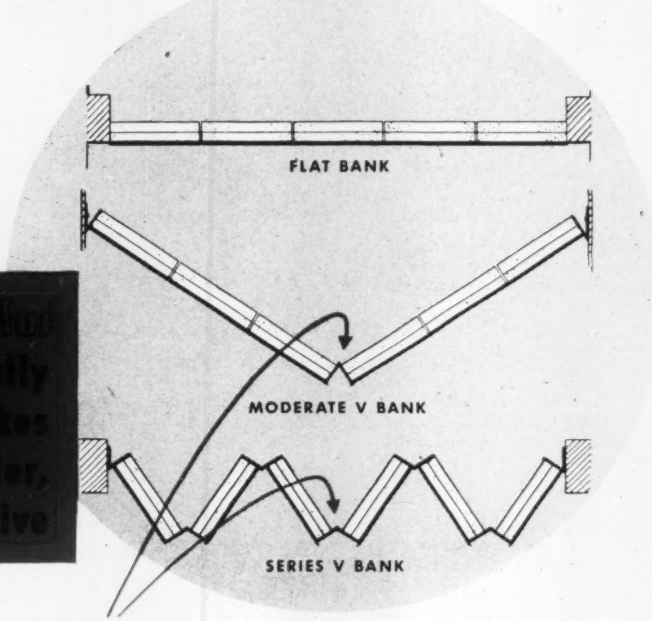
SPANG - CHALFANT
Division of The National Supply Company
EXECUTIVE OFFICES: PITTSBURGH, PA.
District Sales Offices: Atlanta; Boston; Detroit; Houston;
Los Angeles; New York; Philadelphia; Pittsburgh; St. Louis

SPANG
CW

QUALITY
that is recognized wherever pipe is used

NOW ONE FRAME

makes all 3 types of filter banks



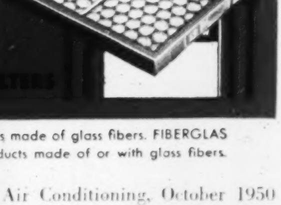
New Fiberglas* DUST STOP Frame is universally adaptable.....makes installations easier, faster, less expensive

Now any ANGLE is possible—The new "universal style" FIBERGLAS DUST-STOP Filter Frame permits you to design and install filter banks that utilize the full width of plenums or wall openings. Angle uprights for V-banks are furnished *in any angle you need to fit the space.* This eliminates filler plates and gives you a better looking and more efficient job.

Self-aligning and self-locking, too!—The newly designed cells are more easily assembled. You simply bend the pre-punched metal dogs of one cell through the square holes of the adjacent frame, and hammer them flat. This *aligns and locks* the cells in position, gives you a tight, rigid bank.

Write today for free Design Data Manual AR6.A1 which gives full information on the new FIBERGLAS DUST-STOP Filter Frame and its use. Owens-Corning Fiberglas Corporation, Department 40-J,
Toledo 1, Ohio.

For better and less expensive air filtration, use FIBERGLAS DUST-STOP Air Filters and Filter Frames



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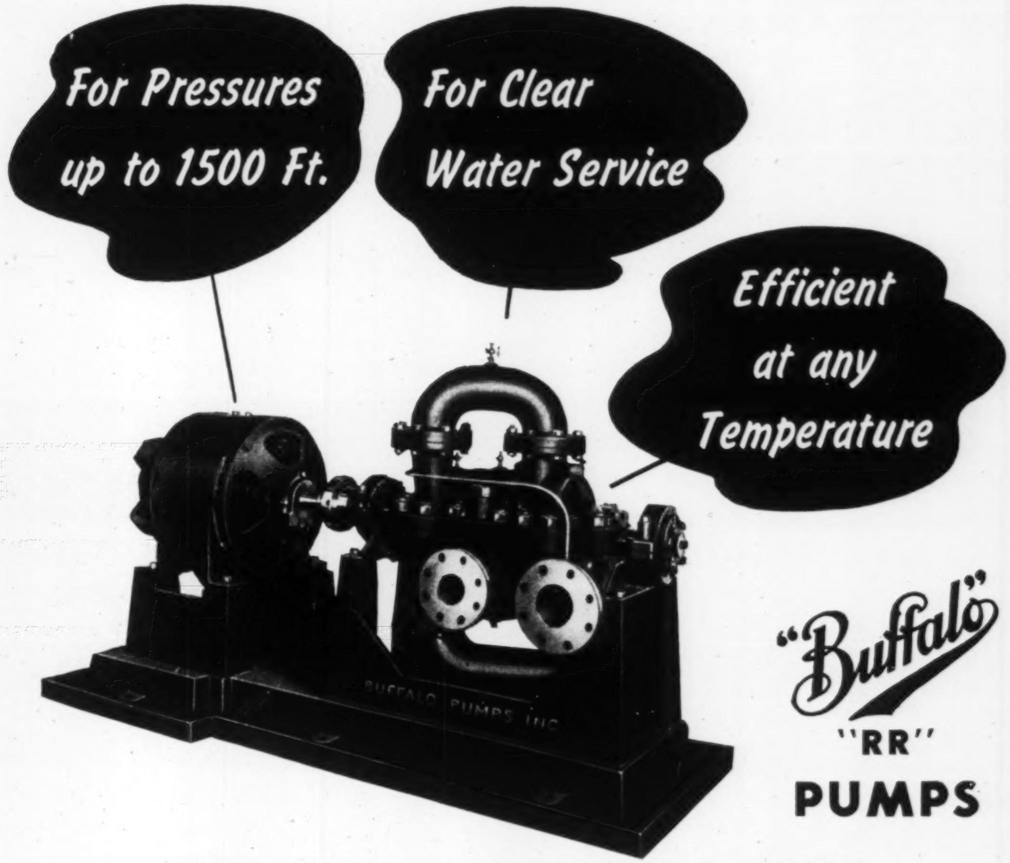
FIBERGLAS* DUST STOP AIR FILTERS

*DUST-STOP is the trade-mark of Owens-Corning Fiberglas Corporation for impingement-type air filters made of glass fibers. FIBERGLAS is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.


For Pressures up to 1500 Ft.
For Clear Water Service
Efficient at any Temperature
BUFFALO PUMPS INC

"Buffalo"
"RR"
PUMPS

READY TO CUT YOUR PUMPING COSTS

If you have a clear-water pumping application calling for a high head and capacity between 20 to 900 gpm., you'll get satisfaction with an "RR". These "Buffalo" Single Suction Two and Four Stage Pumps have set both efficiency and endurance records on the job — in air conditioning, boiler feed and other general service. Thousands in use all over the country. WRITE FOR BULLETIN 980-B for the facts on these pumps users say you can "put in and forget".

—for handling clear water at high pressures, any temperature

"Buffalo"
Class "RR" Single Suction Multistage Pumps

BUFFALO PUMPS, INC.

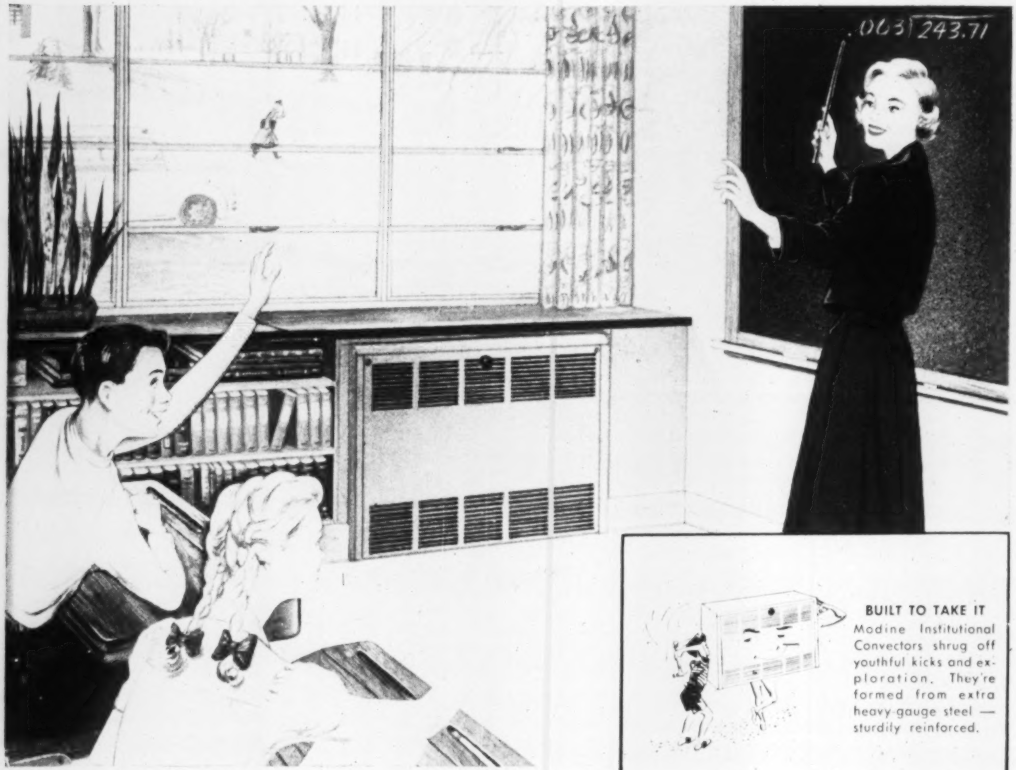
BUFFALO PUMPS, INC.

171 MORTIMER ST. BUFFALO, N. Y.
Canada Pumps Ltd., Kitchener, Ont.
Branch Offices in all Principal Cities

When school bells ring--

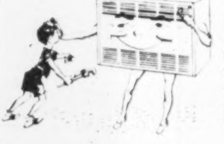
SPECIFY MODINE INSTITUTIONAL CONVECTORS

For Unmatched Comfort . . . Lasting Economy



BUILT TO TAKE IT

Modine Institutional Convectors shrug off youthful kicks and exploration. They're formed from extra heavy-gauge steel — sturdily reinforced.

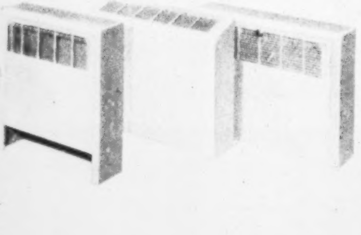


TAMPERPROOF

Lock-type fronts—operated by a special wrench—furnished at no extra cost. For Convectors equipped with dampers, lock-type damper controls also available.

MODINE Institutional Convectors pay off in two important ways. *ONE*, they permit you to take full advantage of the benefits inherent in steam or hot water heating systems. They maintain uniform temperatures from floor to ceiling, even in the coldest weather. *TWO*, Modine Institutional Convectors serve to underline the soundness of your planning — with the economy of dependable, trouble-free service year in, year out.

These exceptional convectors are available with standard heating unit for hot water or two-pipe steam . . . or with the new Quiet-Seal heating unit for one-pipe steam.



Choose from three enclosure types. *Type II* with upper grille and choice of lower opening or lower grille . . . for either recessed or free-standing installation. *Types III and IV* designed for wall placement. Dampers for all enclosures optional at slight extra cost.

Modine

INSTITUTIONAL CONVECTORS

For the full story, call your Modine representative . . . listed in the "Where-to-Buy-it" section of your phone book. Or write direct. Modine Mfg. Co., 1510 DeKoven Ave., Racine, Wis.

R-1065

WeldELLS®

Let's get down to fundamentals: — There is only one *permanent* way to join pipe — only one joint as strong as the pipe itself — the properly *welded* joint.

A properly welded joint involves just two basic factors — a good fitting and good welding. In the WeldELL line you have not only the fitting that expresses the highest development in engineered strength and closely controlled metallurgy . . . you also have the fitting with features that enables the welder to do his job better and faster.

The WeldELL line embraces the widest range of sizes, weights, types and materials. In many sizes and types there are no fittings BUT WeldELLS!

TAYLOR FORGE

TAYLOR SPIRAL PIPE is available in a broad range of sizes and thicknesses. Coupon brings Spiral Pipe Bulletin 493.

TF

TAYLOR FORGE & PIPE WORKS
P. O. Box 485, Chicago 90, Illinois
Offices in all principal cities: *Eastern Plant:* Carnegie, Pa.
Western Plant: Fontana, Calif.

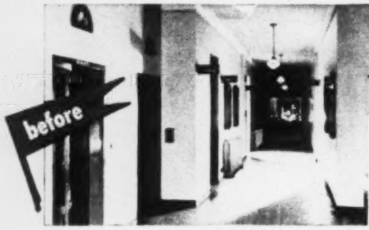
☐ Please send Catalog 484 covering welding fittings and forged steel flanges.
☐ Send Bulletin 493 covering Taylor Spiral Pipe and related fittings.

NAME ____________________
POSITION ____________________
COMPANY ____________________
STREET ADDRESS ____________________
CITY ____________________ ZONE ______ STATE ______

Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

510-1050

MODERN



★ Institutional, commercial and industrial buildings as well as hotels and apartment houses are using Fedders Wall Radiation for efficient, economical heating. Easily installed . . . saves space . . . improves appearance.

★ Puzzle . . . find the heating equipment! Instead of old, bulky, dirt-collecting radiators, new Fedders Baseboard Radiation surrounds everyone with comfort. No interference with draperies or furniture placement. Fedders exclusive anti-streak design prevents streaking of walls.

★ See how Fedders Convector-Radiators changed the complexion of this bedroom by making a smart new console unit take the place of an old-fashioned radiator.

fedders

RADIATION

[illegible]

[illegible] than every other type of [illegible] tion.

Write for bulletin [illegible]

[illegible] QUIGAN CORPO[illegible]

[illegible] NEW YORK

NEW
RELIEF VALVES!
BUILT TO ASME CODE...
TESTED AND RATED BY
NATIONAL
BOARD
BOILER
DRAIN
SAFETY RELIEF VALVE
ASME
BELL & GOSSETT CO

No. 175 Relief Valve

Catalog Number	Size	Capacity	Max. Setting
175	¾"	175,000 BTU/HR	30 LBS.

Nos. 250-699 Relief Valves

Catalog Number	Size	Capacity	Max. Setting
250	¾"	250,000 BTU/HR	30 LBS.
699	¾"	[illegible] BTU/HR	30 LBS.

No. 1000 Relief Valve

Catalog Number	Size	Capacity	Max. Setting
1000	1½"	1,000,000 BTU/HR	30 LBS.

Nos. D-175 and D-250 Dual Unit Valves

Catalog Number	Conn. Sizes	Capacity Relief Valve	Max. Setting
D-175	½" MAKE-UP WATER ¾" BOILER 1" DRAIN	175,000 BTU/HR	30 LBS.
D-250	½" MAKE-UP WATER ¾" BOILER 1" DRAIN	250,000 BTU HR	30 LBS.

Reducing valve is factory-set at 12 lbs.

These new B & G Relief Valves are designed and built to comply with the requirements of the ASME Code and are entitled to be labelled with the appropriate code symbol.

This is important to you since many cities and states are requiring ASME rated relief valves which have capacities equal to or greater than the maximum output of the boiler.

B & G Relief Valves with ASME ratings offer these features in excess of Code requirements:

1. They are not "pop" type valves. Diaphragm operation transmits more power during opening and closing of valve.
2. No guides on discharge side to stick or jam.
3. New low differential of not to exceed three pounds between opening and closing pressures.
4. Ground and polished metal-to-metal seats. Age or use will not deform them.

Wide range of capacities permits close matching of relief valve capacity to boiler load. Be sure to examine this new line of B & G Valves before you buy again.

B & G

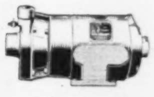
Hydro-Flo PRODUCTS

Forced Hot Water Heating Systems . . . Water Heaters . . . Centrifugal [illegible]

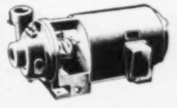
BELL & GOSSETT COMPANY

Canadian Licensee: [illegible]

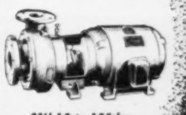
ALLIS-CHALMERS PACKAGE PUMPS



SSR Fractional hp.



Electrifugal 1 to 10 hp.



SSU 10 to 125 hp.

NEW

Air Conditioning Pumps

LOW COST, QUIET, DEPENDABLE

HERE IS A PUMP SPECIFICALLY DESIGNED for air conditioning contractors and manufacturers of air conditioning equipment. It offers the high quality features for which Allis-Chalmers pumps have always been known at a competitive price. Easy to mount and connect, it operates very quietly and requires a minimum of service.

Quality Features At Low Cost

The motor is a NEMA standard design. Pump and motor are rigidly connected by an adapter to form a single unit which requires only 4 bolts to mount.

A mechanical seal which requires no packing and no maintenance is used.

The discharge opening can be moved to any of four positions by simply changing the position of four bolts. The impeller can easily be removed with a screw driver and a hex head socket wrench.

Free Engineering Help

Your nearby Allis-Chalmers representative will be glad to help you engineer your installation or equipment to assure you of good performance at low cost.

Nation-wide Service

Nearly every industrial city has one or more Allis-Chalmers Certified Service Shops to provide you and your customer with factory approved parts and service. Sizes range to 80 gallons per minute with heads to 100 feet; open or closed impeller depending on size. Vertical mounting bracket available in many models.

Send For **COMPLETE INFORMATION**

ALLIS-CHALMERS, 1171A SO. 70 ST.
MILWAUKEE, WIS.

Please send me Bulletin 52B7529 describing your air-conditioning pump.

Name

Company

Title

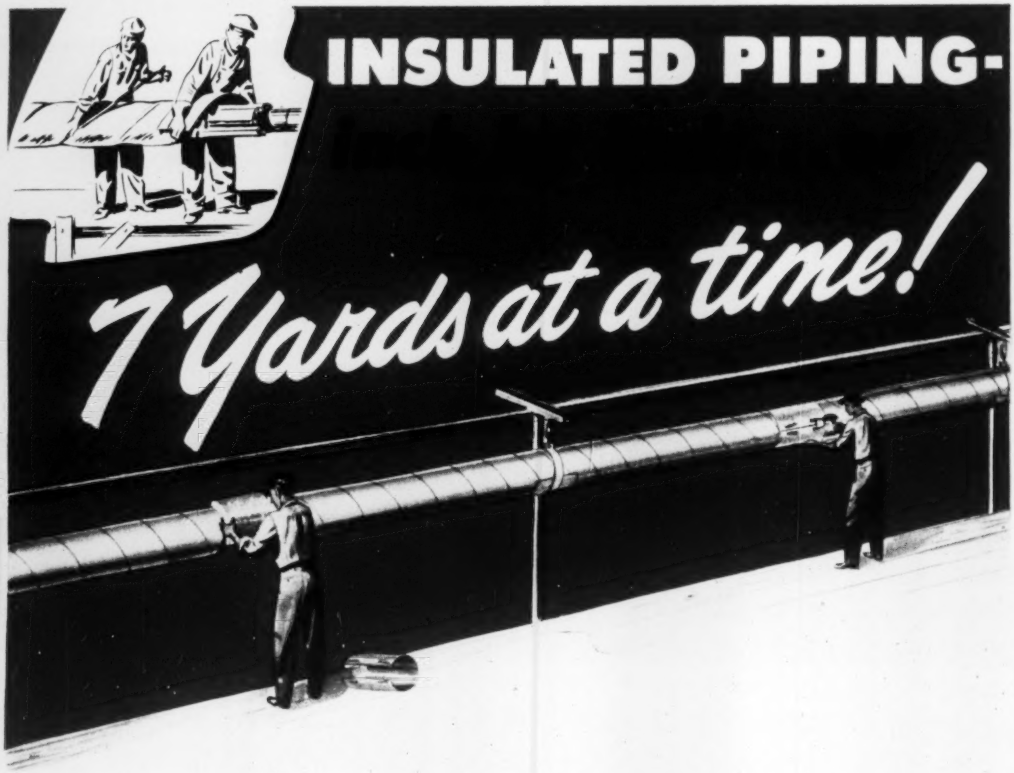
Address

City State

A-3182

A-C ALLIS-CHALMERS

ALLIS-CHALMERS



INSULATED PIPING-

7 Yards at a time!

Cost-conscious contractors and industrialists realize the great installation advantages made possible by Ric-wiL prefabricated 21-foot "straight-run" sections and prefabricated accessory units.

This, however, is only one of the reasons why Ric-wiL is known as "the greatest name in insulated piping systems".

Forty years of experience and production "know-how" go into manufacturing Ric-wiL piping systems for conveying process liquids with the highest thermal and operating efficiency and lowest maintenance cost.

The high-grade materials used in FOIL-CLAD and HEL-COR Insulated Piping provide extreme durability in operation and superior resistance to all types of weathering or corrosive action. Ric-wiL pre-installation engineering eliminates costly cut-fit-and-try methods. Call the nearest Ric-wiL office and our representative will be glad to discuss your specific problem at your convenience.

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Department 1-U in Cleveland, O.

RIC-WIL

INSULATED PIPING SYSTEMS

THE RIC-WIL COMPANY • CLEVELAND, O.

OVERHEAD **UNDERGROUND**

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEM

More **CRANE VALVES** are used than any other make

Standards for disc face finish
are established by electronic method
giving micro-inch readings.

How CRANE controls quality to the Micro-Inch to cut your valve costs

Surface finish of a valve's working parts has a lot to do with its wear resistance and operating efficiency. A correct finish means a tighter-seating valve, easier operation, greater ease of maintenance. In Crane Quality valves, the surface finish of machined parts is measured and controlled to rigid limits. The standards for quality control of surface finish are determined by the most scientific methods as shown above. Yes, nothing is overlooked to make Crane Valves the lowest-cost valves in the long run. *That's Crane Quality!*

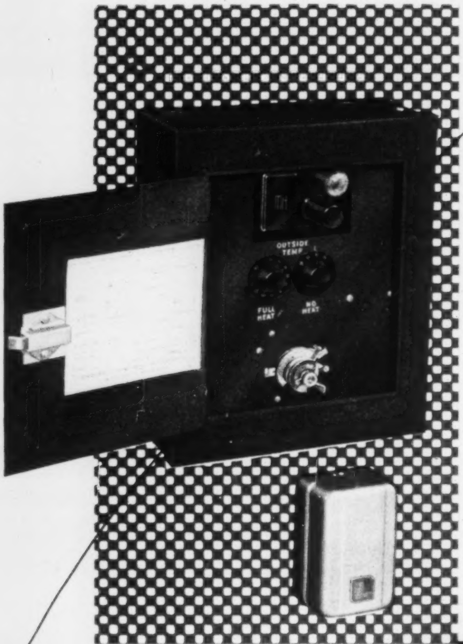
Precise quality control of materials, design, and manufacturing—to the highest degree in the industry—makes Crane valves the lowest cost valves in the long run. On steam service, oil and oil vapor lines, for example, you'll find Crane Steel Gate Valves a sure remedy for high maintenance costs. Talk it over with your Crane Representative.

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

New Electronic Outdoor Controller Honeywell Cyclotrol . . . . a Real Fuel Saver for Apartments, Hotels and Commercial Buildings...Saves Fuel with Automatic Night Shutdown and Morning Pickup



YOUR customers gain many important advantages when you install Cyclotrol— Honeywell's new *electronic* outdoor control package.

It's low priced. It's easily installed by any workman. And, most important, Cyclotrol brings important fuel savings.

Especially designed for apartments, hotels and commercial buildings, this control maintains minimum "on" cycles for heat distribution in all weather. To prevent overheating in mild weather, the number of cycles is automatically reduced. Also, Cyclotrol automatically determines the length of both the on and off periods in accordance with outdoor weather conditions, rather than the usual fixed time cycle. Being electronic, it is supersensitive, fast in response and has no moving parts.

It will pay you to get all the facts *now* about Cyclotrol. Simply call the Honeywell office in your city or address a card to Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Toronto 17, Ontario.

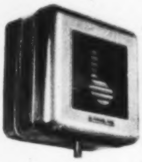
Send for Cyclotrol booklet SA1501.

MINNEAPOLIS
Honeywell
CONTROL SYSTEMS

77 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

American Blower—a time-honored name in air handling

In the San Francisco area, for air handling data call American Blower—Sutter 1024. In other areas consult your phone book. Note: To better serve our western customers American Blower has built another new plant—conveniently located in San Leandro, California.



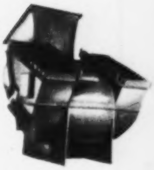
Venturafin
Unit Heaters

Type TM
Gyrol Fluid Drives

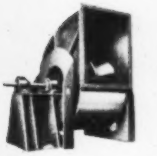
Utility Sets

Ventura
Ventilating Fans

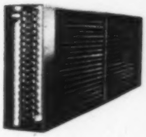
Dust Collectors



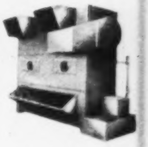
Mechanical
Draft Fans



Industrial Fans



Heating and
Cooling Coils



Air Conditioning
Equipment

If you look before you buy, we're certain you'll buy American Blower Air Handling Equipment. There's a vast difference in quality, design, quietness, operating costs and efficiency. Buyers' tests prove the superiority of American Blower products.

Air is free . . . use it profitably!

No matter what business you're in, or where you're located, bear these two things in mind:

1. There are American Blower Air Handling Products which are ideally suited to help you put air to work profitably.
2. There is an American Blower Branch Office strategically located to assist you.

And no matter what type of American Blower equipment you buy, you get these plus advantages:

Equipment built by a reputable manufacturer with a background of 69 years of experience—equipment which is tested in accordance with the Standard Test Code and carries Certified Ratings—equipment which is the result of the broadest and most thorough methods of engineering and research known.

To buyers of air handling equipment, these plus values build confidence and insure longer, more dependable service and lower operating costs.

To contractors with an eye to the future, these same factors insure satisfied customers and fair profits.

Our nearest branch office will give you full data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary corporation

YOUR BEST BUY
AMERICAN BLOWER
AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Wrap your troubles in

ULTRALITE

DUCT INSULATION and DUCT LINER

and deliver better jobs . . . faster . . . cheaper!

Just *once*, try Ultralite, the long glass fiber insulation—and you'll never use any other insulation! For Ultralite goes on *faster, easier, cheaper* . . . and it does a better job of deadening sound and keeping heat and cold where they belong.

No need to handle Ultralite with kid gloves, for it's tough, resilient — won't break, flake, chip or dent. You can cut it readily with a knife, wrap ducts as you would a package. You can run it quickly around curves and corners. You can fasten it in place with wires or metal screws and washers or cement. And Gustin-Bacon offers *six different vapor barrier facings*, one of which is tailor-made for your particular condensation problem.

The superior thermal and acoustical properties of Ultralite in various thicknesses and densities are readily apparent from the charts in A.I.A. file No. 37-D-2. You'll like, too, the physical properties of Ultralite. The long glass fibers are fire-resistant, non-corrosive, non-irritating and as permanent as glass itself. Ultralite will not settle, shake loose, delaminate or disintegrate under air movement or vibration, nor will it pick up odors. Try Ultralite in your shop . . . soon!

For free samples and A.I.A. file No. 37-D-2, WRITE TODAY!

Please send me samples of Ultralite and A.I.A. file 37-D-2.

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GUSTIN-BACON MFG. CO.

1412 WEST 12TH ST., KANSAS CITY, MO.

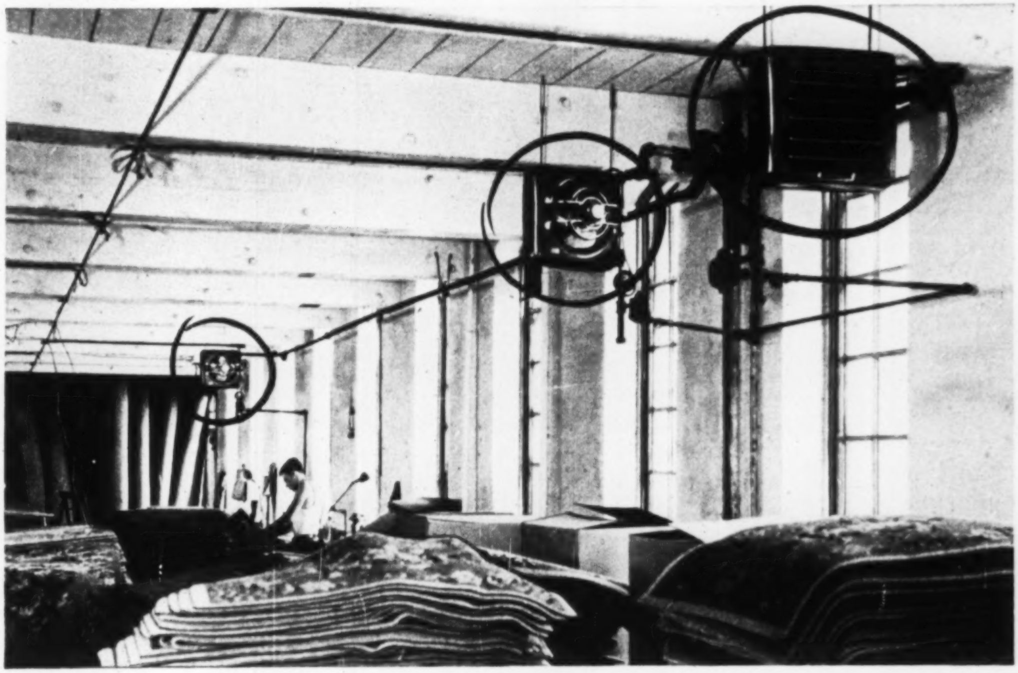
New York Chicago Philadelphia San Francisco Los Angeles
Houston Tulsa Ft. Worth

The cost of heating takes a beating at Columbia Carpet

MANY firms today are paying too much for heat, but not Columbia Carpet Mills, Inc., Philadelphia. Columbia has the cost of heating well under control with a Carrier installation. Circled here are some of the units that do the job.

These Carrier Horizontal Discharge Unit Heaters have a lot to recommend them. Their revolutionary single-row coil construction offers less air resistance, reduces power consumption, facilitates cleaning. Their adjustable discharge louvers provide control of the heat flow where it's needed, eliminate dead spots. Though light in weight, they're so ruggedly built they're right for heavy duty in factories and garages. And they're so handsome they're also ideal for quality stores and exclusive shops.

Economy of operation and long life are built into all Carrier Unit Heaters. Whatever the job, you and your clients can count on them for superior performance. The Carrier name is assurance of plus values. Carrier Corporation, Syracuse 1, New York.



What's the job? Here's the Heater for it!

Carrier 46U Horizontal Discharge Unit Heater. Sturdy and attractively styled. With steam or hot water. Capacities: 13,400 to 200,000 Btu's per hour.

Carrier 46S Four-way Directed-flo Unit Heater. For quick heat from relatively high ceiling suspension. With steam or hot water. Capacities: 49,000 to 500,000 Btu's per hour.

Carrier 46T Gas-fired Unit Heater. AGA approved. With LP gas, and manufactured, mixed and natural gases. Heart of Aluminized Steel for long life. Capacities: 70,000 to 230,000 Btu's per hour.

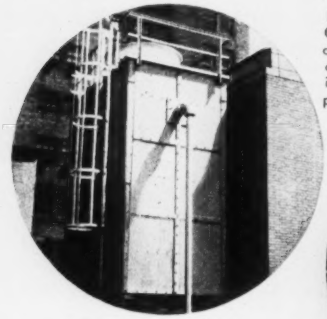
Carrier 46PQR Heat Diffusers. For heating large enclosed areas at low cost. With multiple outlets and adjustable louvers. Floor, wall or ceiling mounted. Capacities: up to 1,500,000 Btu's per hour.

Carrier **Air Conditioning • Refrigeration • Industrial Heating**

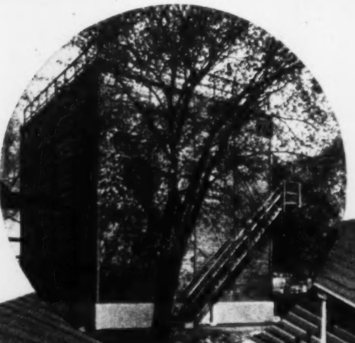
the same engineering excellence

in every Foster Wheeler

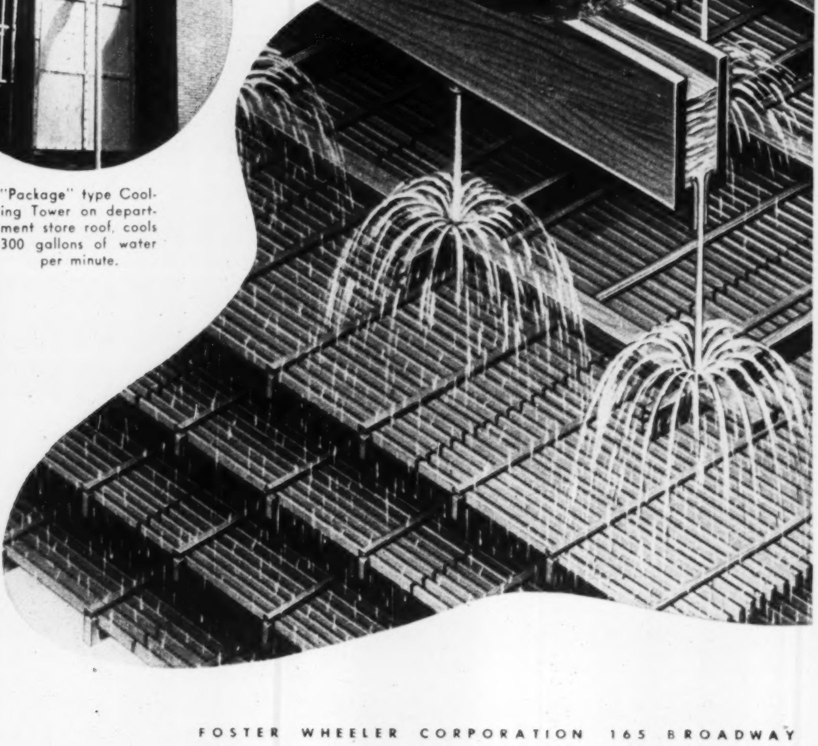
FROM THE SMALLEST...



"Package" type Cooling Tower on department store roof, cools 300 gallons of water per minute.

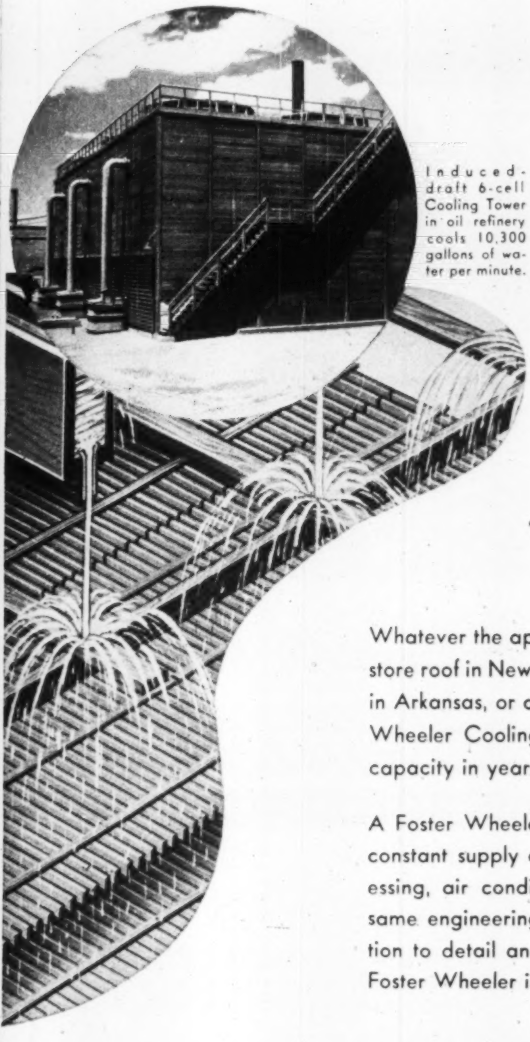


Induced-draft 1-cell Cooling Tower, which cools 5,000 gallons of water per minute in food processing plant, blends with landscape.

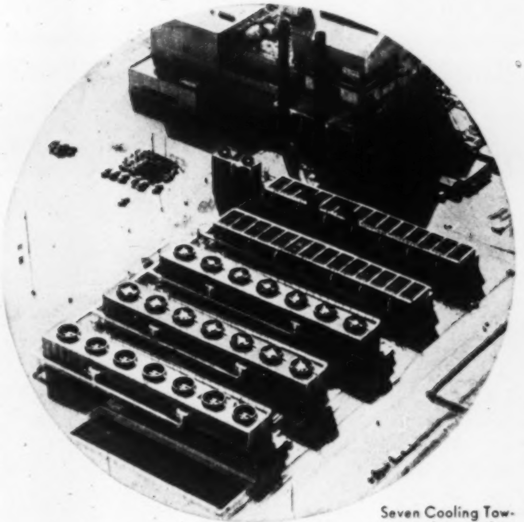


FOSTER WHEELER CORPORATION 165 BROADWAY

cooling tower



Induced-draft 6-cell Cooling Tower in oil refinery cools 10,300 gallons of water per minute.



Seven Cooling Towers cool more than 180,000 gallons of water per minute in large power plant.

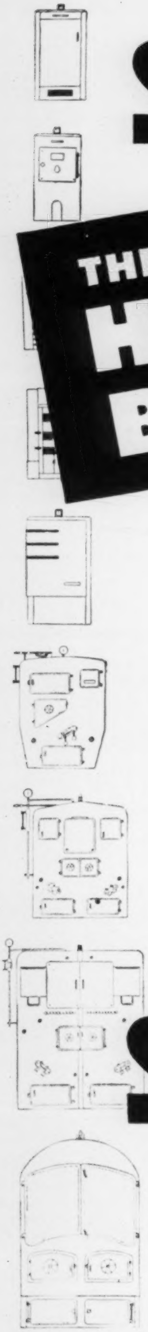
...TO THE LARGEST

Whatever the application—a "package" type on a department store roof in New York City, a twenty-cell tower for a power plant in Arkansas, or a large unit for a chemical plant in India, Foster Wheeler Cooling Towers can be depended on to deliver full capacity in year-round service.

A Foster Wheeler Cooling Tower is your best guarantee of a constant supply of cooling water for steam power plants, processing, air conditioning, or other uses. Regardless of size, the same engineering and construction excellence, the same attention to detail and the same quality of materials go into every Foster Wheeler installation.

NEW YORK 6, NEW YORK

FOSTER FW WHEELER



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THE QUALITY LINE OF
HEATING BOILERS

BACKED BY MORE THAN 60 YEARS' LEADERSHIP

versatile: Boilers for all types of fuel and all methods of firing. Capacities from 290 to 45,000 square feet, steam.

dependable: Precision-engineered and manufactured to give superior, *guaranteed* service.

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SPENCER

Constructed in accordance with ASME requirements. Fully approved by Steel Boiler Institute or Institute of Boiler and Radiator Manufacturers.

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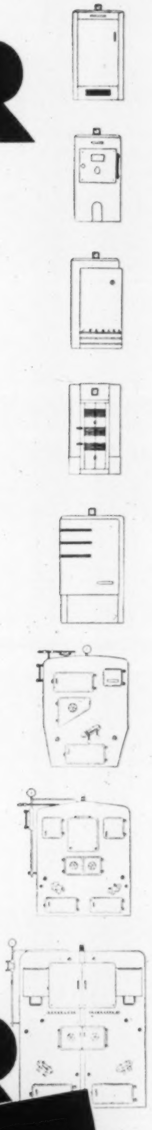
THERE IS A SPENCER FOR EVERY BUILDING . . . FOR EVERY FUEL

SPENCER HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

including 34 Steel Heating Boilers for Commercial Installations

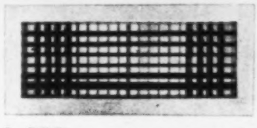


1ST IN AIR DISTRIBUTION PERFORMANCE... IN VALUE PER DOLLAR...

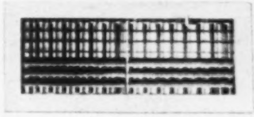
A COMPLETE LINE
THERE'S NO FINER
GRILLE THAN AIRFOIL

S-2 Featuring vertical front louvers and horizontal rear louvers.
L-2 Featuring horizontal front louvers and vertical rear louvers

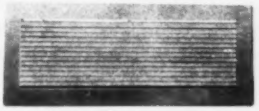
AirFoil AIR CONDITIONING OUTLETS



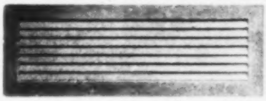
L-270 4-way directional grille for complete control of air stream.



L-274 Double directional grille with multi-shutter damper.

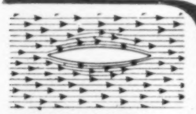


RL-21 Return air grille fixed deflection type.



RL-230 Return air grille extra rugged construction.

AG-25 Volume controller designed to fit behind grille.

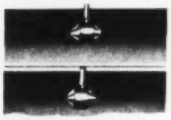


EXTRA WIDTH AIRFOIL LOUVER

Wide louver surface gives unequalled, directional control of air flow. Glass-smooth streamlining eliminates noise—turbulence. Solid section adds much strength.

EXTRA HEAVY RUBBER GASKET

Seals grille tightly to wall. Eliminates ugly dust streamers—cuts cleaning expense.



EXCLUSIVE PAT. CONCEALED CYL. SUPPORT . . . Allows grille to be made to meet special requirements of any size or shape. Eliminates mullions and ugly butted construction. Adjusts easier.

THESE PRIME FEATURES *GUARANTEE* PERFORMANCE UNOBTAINABLE WITH ANY OTHER GRILLE . . .

- **EXTRA WIDE BEVELED BORDER**
- **SMOOTH—MITERED CORNERS**
- **ATTRACTIVE EXTRA-DURABLE FINISH**
- **COUNTER SUNK SCREW HOLES**
- **UNIFORM LOUVER TENSION**

HIGH QUALITY—SAVES MONEY

Precision manufactured AIRFOIL GRILLES work *right* . . from the first. Eliminate costly replacement or adjustment "Call-Back". Adjust easy . . install easy. Assure lasting customer satisfaction.

STRONGER—YET EXTRA LIGHT

Workmen lift less weight. Contractors save costly TIME and LABOR. Solid AIRFOIL section adds strength. ONE-PIECE, super-strong frame cuts weight. Design is extra neat with eye-catching beauty.

FREE

Send for complete illustrated literature. Check box for special additional information.

☐ Air conditioning outlets
☐ Return air grilles and registers
☐ Volume controllers
☐ Perforated metal and ornamental grilles
☐ Door ventilators
☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

☐ Rush information on L-2 or S-2.
☐ Send complete catalog.
☐ Send literature on above checked items.

NAME ____________________
ADDRESS ____________________
CITY ____________________ STATE ____________________

2 GREAT PIPE INSULATIONS

Unibestos No. 750 - to 750°F.
Unibestos No. 1200 - to 1200°F.

UNARCO
UNIBESTOS PIPE COVERING
Manufactured by UNION ASBESTOS & RUBBER CO. CHICAGO, ILLINOIS, U.S.A.

Available in Cylinders or Half-rounds

UNIBESTOS®

. . . single-layer application saves money

When you can insulate a pipe efficiently with only one layer of covering, you save money. The range of thicknesses in which Unibestos Pipe Insulations are made permits the economies of single-layer application. Also a distinct saving in warehousing is made possible because fewer sizes of insulation are required in stock for maintenance work. But range of insulation thicknesses for single-layer application is only one of the many features of these 2 great pipe insulations—UNIBESTOS No. 750 and No. 1200. Write today for catalog giving complete information.*

UNARCO

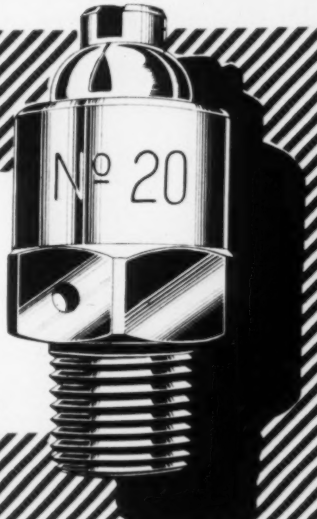
UNION ASBESTOS & RUBBER COMPANY

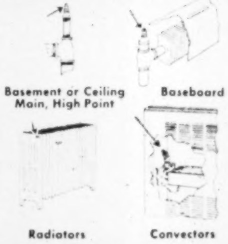
1819 A SOUTH 54th AVENUE • CICERO 50, ILLINOIS

New 8-page catalog (No. 48-1023) "UNARCO Insulations • Asbestos Packings • Gaskets • Textiles"

3 Remarkable New Items

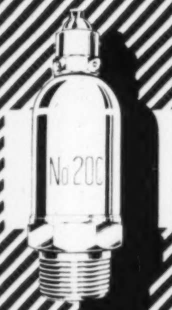
For Customer Satisfaction





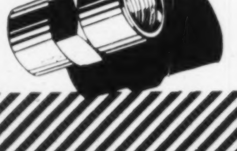
Completely automatic, it eliminates air from convectors and radiators. No preliminary soaking is required. This simple, ingenious valve works equally well on new or existing heating plants with forced circulation or gravity systems. Simple to install — Easy to select the function you desire, manual or automatic venting or manual shut-off.

DOLE-20 HOT WATER AIR VALVE



DOLE CHAMBER VENT

A combination hot water air valve and air chamber that is fully automatic. Designed specially for venting convectors, etc. on hot water heating systems. Available in ⅛", ¼", ½" & ¾" I.P.T. sizes.



DOLE FLOW CONTROL VALVE

A simple, practical valve that regulates water flow. Limits discharge to a pre-determined gallonage regardless of city water pressure from 15 to 150 lbs. p.s.i. No more cool water from overdrawn tankless heaters. Many other uses.

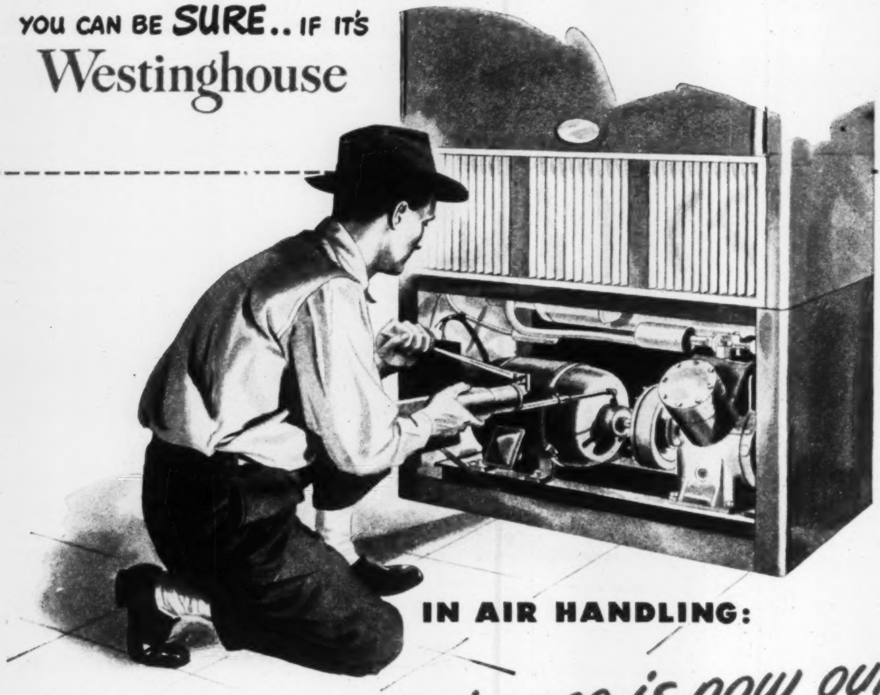
DOLE

No. 20 HOT WATER AIR VALVE
CHAMBER VENT
FLOW CONTROL VALVE

CONTROL WITH DOLE

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



IN AIR HANDLING:

this lubrication nuisance is now out!

In offices and stores . . . in the thousand and one spots where fans, blowers and air-conditioning equipment are installed, motor lubrication is a costly nuisance. Think how much better a Life-Line motor fits these applications. Bearings are pre-lubricated. Grease cups . . . lubrication maintenance . . . dripping grease—all are gone. With Life-Line motors installed, you can mark motors off your greasing maintenance chart.

For the builder of air-handling equipment this means: Install Life-Line motors in inaccessible locations. Mount them vertically, horizontally, or any angle "in between". Grease is sealed in—can't drip. Correct lubrication is positive.

Pre-lubrication is but one feature of the Life-Line motor. Check its absolute smoothness and freedom from noise-producing vibration. Call your nearby Westinghouse representative for a copy of the Life-Line booklet, B-3842 or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-21563

WESTINGHOUSE

Westinghouse
Life-Line
Motors
INDUSTRY'S LEADING MOTOR

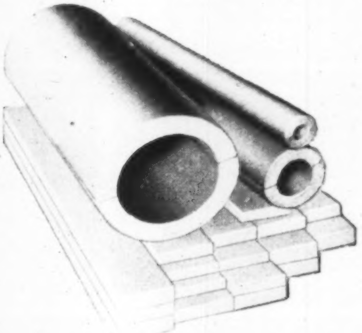
If you figure LIFE-COSTS . . . you'll figure LIFE-LINE

KAYLO HEAT INSULATION PASSES THESE SEVERE TESTS

BOILING TEST: Samples of Kaylo Heat Insulation have been boiled continuously for 24 hours and longer. None disintegrated or showed any loss of insulating efficiency after drying.

FUME TEST: Samples of Kaylo Heat Insulation were suspended in an aerated mixture of water vapor and SO_2. The Kaylo samples showed no deterioration after weeks of direct exposure.

One Material Insulates Efficiently up to 1200°F.



Kaylo Heat Insulation is made of hydrous calcium silicate (not glass), a remarkable material with high insulating efficiency up to 1200°F. This new type of inorganic insulating material retains its stability in long service under severe conditions. Exceptional strength and lighter weight make it easier to handle and apply.

KAYLO PIPE INSULATION is produced in Simplified Dimensional Standards of thicknesses and diameters for pipe sizes from ½" to 72". Coverings are sectional for sizes ½" to 12"; tri-segmental for 8" to 23"; quad-segmental for 19" to 41"; K-segmental (18" sections) for 38" to 72". O.D.'s of insulation correspond to O.D.'s of standard pipes.

KAYLO HEAT INSULATING BLOCK is available for single layer application in thicknesses from 1" to 6". It is made in all standard sizes up to 18" x 36".

SEND COUPON FOR KAYLO HEAT INSULATION LITERATURE

KAYLO®

PIPE INSULATION AND HEAT INSULATING BLOCK

OWENS-ILLINOIS GLASS COMPANY
Kaylo Division • Toledo 1, Ohio

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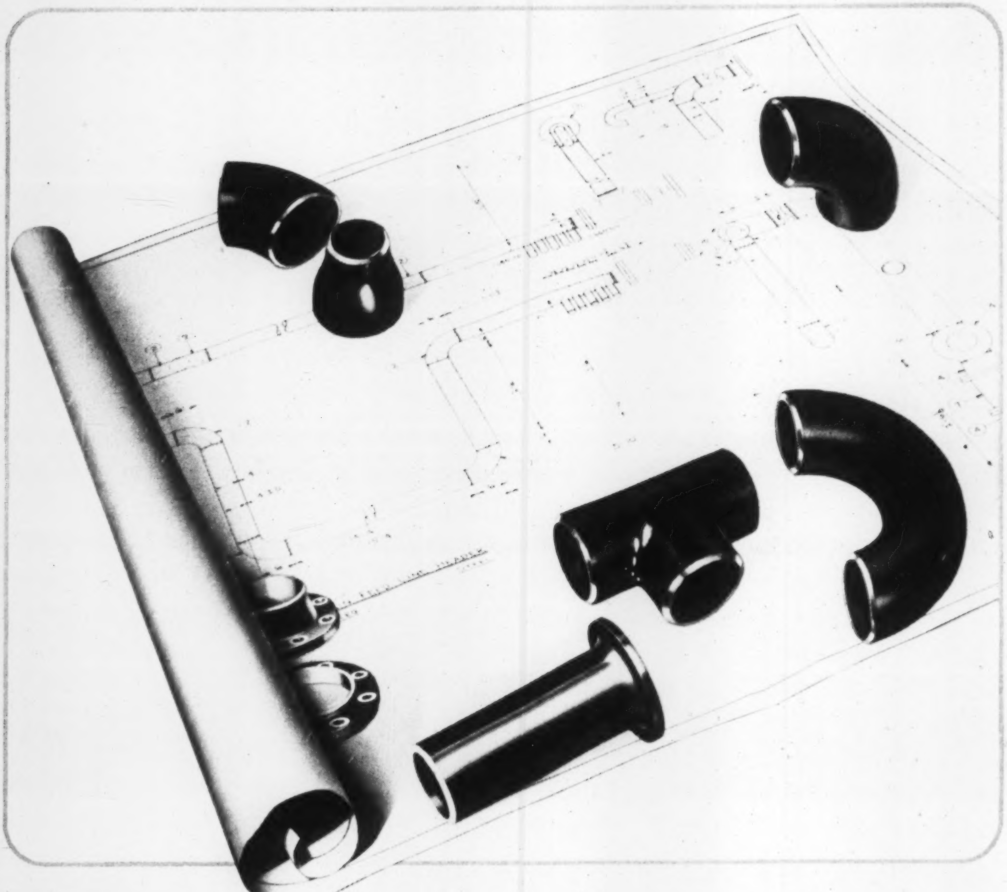
OWENS-ILLINOIS GLASS COMPANY
Dept. N-96, Kaylo Division • Toledo 1, Ohio

Gentlemen: Please send me descriptive literature on Kaylo Heat Insulation.

NAME..
FIRM..
ADDRESS..
CITY.................................STATE.....................

TO DO A BETTER PIPING JOB . . .



USE . . .

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

When you specify and use Globe Welding Fittings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin
Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia
St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

Send for the Globe Welding Fittings Catalog — and look to Globe as a preferred source of supply.

BRUNNER SINCE 1906 **REFRIGERATION helps you serve better**

Your Good Name and Ours

could form a profitable partnership

Talk to anyone in the trade who has specified and installed Brunner Refrigeration Condensing Units and they'll tell you *from experience* what it means in business dollars and cents to deal with a progressive, understanding organization that builds its products just a little bit better than is expected.

You, as a contractor, need not be told how much easier it is to "sell" a job when you are in a position to specify and deliver *known* and *accepted* equipment.

The Brunner Manufacturing Company, with all their 44 years continual growth, has moved ahead so fast these past few years there are still some aggressive contractors who have missed the important details of what we may be able to contribute to their efforts toward securing more *profitable* business.

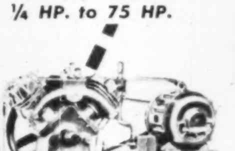
If you are at all concerned in the specifying and installation of refrigeration and air conditioning equipment, Brunner has a story to tell that you should at least know about. A factory representative will call without obligation. Write us and say when.

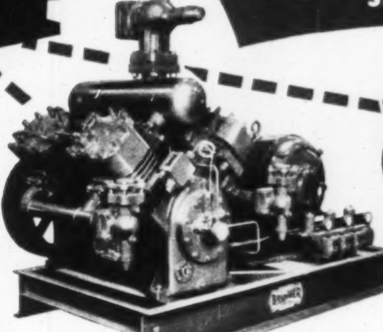
BRUNNER MANUFACTURING COMPANY
UTICA 1, NEW YORK, U. S. A.

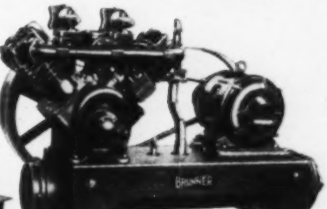
BRUNNER
SINCE 1906

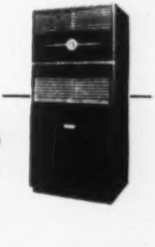
REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

AIR AND WATER COOLED MODELS
¼ HP. to 75 HP.









BRUNNER SINCE 1906

AIR CONDITIONING

Self Contained Units in 4 sizes: 3 - 5 - 7½ and 10 HP.
Remote Installation Types from 5 to 75 HP.

Century 1 TO 400 H. P. MOTORS

Choose From These Many Types To Fit Your Job

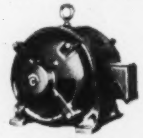
DEPENDABLE CONSTRUCTION . . . Plus PROPER SELECTION MINIMIZE SHUTDOWNS

It's easy to select the proper electric motor for your job from Century's complete line — from 1/6 to 400 horsepower. A wide range of types and kinds are available to satisfy all popular requirements. They are carefully designed, built and tested to assure maximum performance throughout their long life.

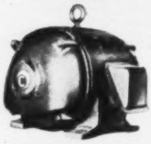
Here are examples of Century's line of INTEGRAL HORSEPOWER motors.

Polyphase

TYPE SC—Open Drip proof General Purpose Motor. Meets the needs of most installations where operating conditions are relatively clean and dry.



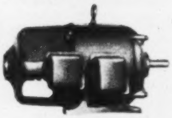
TYPE SC—Splash proof. Supplies protection where plants must be washed down. Keeps out all falling or splashing liquids — rain, snow, sleet, etc.



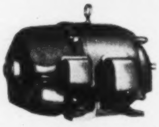
TYPE SC—Totally Enclosed Fan Cooled. Protects against dusts, mist, oil, fog. Inner frame protects vital parts of the motor, seals out harmful matter.

TYPE SC—Explosion proof. Protects life and property in atmospheres charged with explosive dusts or gases.

TYPE SR—Wound Rotor. Open Construction. Ideal for applications requiring low starting current with high starting torque, reversing or adjustable speed.

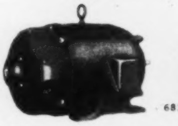


TYPE SR—Wound Rotor Splash proof. Same electrical characteristics as motor shown above. In addition, gives adequate protection against falling and splashing liquids.

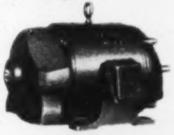


Single Phase

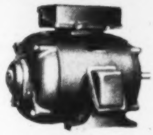
TYPE RS—Repulsion Start Induction, Open Construction, Single Phase Brush Lifting Motor. Combines high starting torque with low starting current.



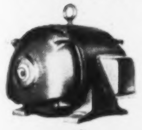
TYPE RS—Splash proof. Same advantages as open construction, plus protection against splashing and falling liquids.



TYPE CSH—Capacitor Start Induction, Single Phase Motor. Suitable when high starting torque with normal starting current is satisfactory.

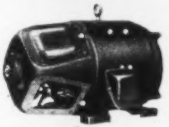


TYPE CSH—Splash proof. Same advantages as motor shown above, plus protection against falling and splashing liquids.



Direct Current

TYPE DN—Direct Current Motors. Suitable for use where direct current is available, or its use desirable.



TYPE DN—Direct Current, Splash proof.

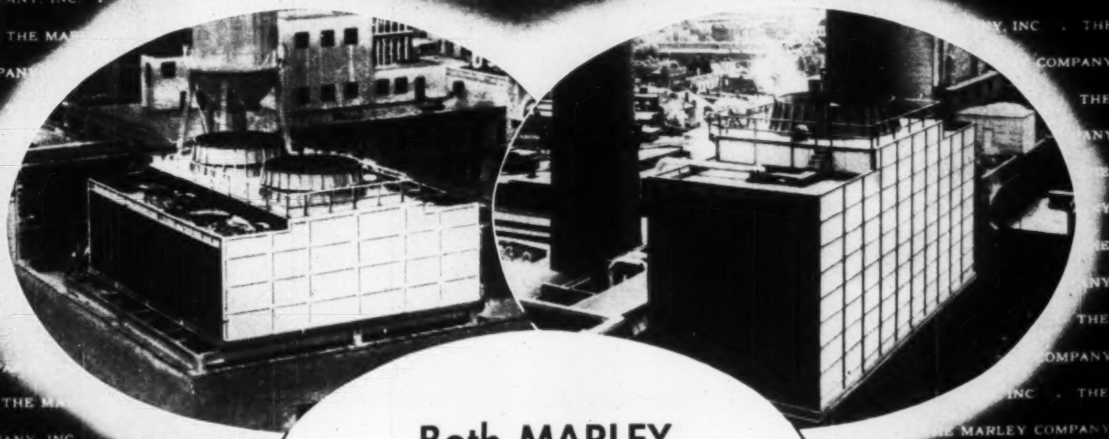
TYPE SY—Synchronous. Suitable for continuous operation at a uniform load for power factor correction.

In addition to a complete line of integral horsepower motors, Century offers fractional horsepower motors, gear motors, generators, AC and DC motor generator sets.

683

For a long life of satisfactory performance, specify Century motors for all your electric power requirements.

CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri • Offices and Stock Points in Principal Cities



Both MARLEY Double-Flows

They're Different! Why?

NO two water cooling requirements are exactly alike! Water temperatures and gpm vary, horsepower requirements differ, space limitations are dissimilar, wet bulb conditions are not the same.

Recognizing this fact, Marley Double-Flow cooling towers are available in a wide range of sizes so you can fit a standard Double-Flow to your job . . . not the job to the cooling tower.

For example, the Marley Double-Flow on the left is used for air-conditioning service in a large department store in a climate where temperatures vary widely. Here it was desired to have a tower with four cooling cells and two fans to provide utmost flexibility . . . one, two, three or four cooling cells operating independently. A low silhouette was needed to save conflict with the city skyline. And, a broad-based tower allowed the weight to be distributed over a wide area. In order to meet a building code, the California redwood tower was cased with asbestos-board.

The Marley Double-Flow on the right was selected for one of the world's largest breweries. In this case, a tower was needed to cool a large gpm of water. Because of space limitations, the tower was erected on a high, elevated grillage with the area beneath the tower available for material storage. The cold water basin of the Double-Flow tower became the roof of the storage area.

These are only two of the hundreds of case histories in Marley files on operating Double-Flows that show how standard, low priced Double-Flow towers are expertly applied by trained application engineers.

Although sizes vary, all Marley Double-Flow cooling towers have many exclusive features . . . open distribution system, easy inspection and regulation, two independent cooling cells for each fan, nail-less filling, more drift eliminator area and Marley mechanical equipment. And, all Double-Flows are backed by the Marley guarantee.

Modern automatic machines and skilled craftsmen in three plants, enable Marley to furnish accurately fabricated towers to fit your job at a savings to you. If you have a water cooling problem, let Marley "know-how", starting in the blue-print stage, help you get MORE FOR YOUR MONEY by "custom tailoring" an economical, standard Marley Double-Flow to meet your specific needs.

MAIL THIS COUPON TODAY

The Marley Company, Inc., Kansas City 15, Kansas

☐ I'd like to know more about DOUBLE-FLOW Cooling Towers. Please send FREE Bulletin DF-50.

☐ Have Engineer call, at no obligation to us, to discuss our water cooling needs.

HP-10

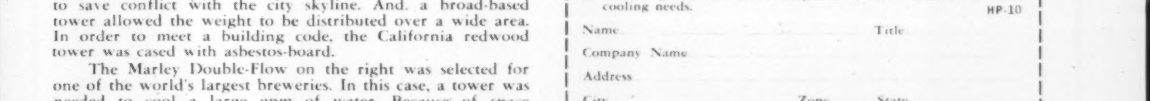
Name Title

Company Name

Address

City Zone State

MARLEY



Fast Acting Fire Watchman

C-O-TWO
SMOKE DETECTOR

on duty 24 hours a day...

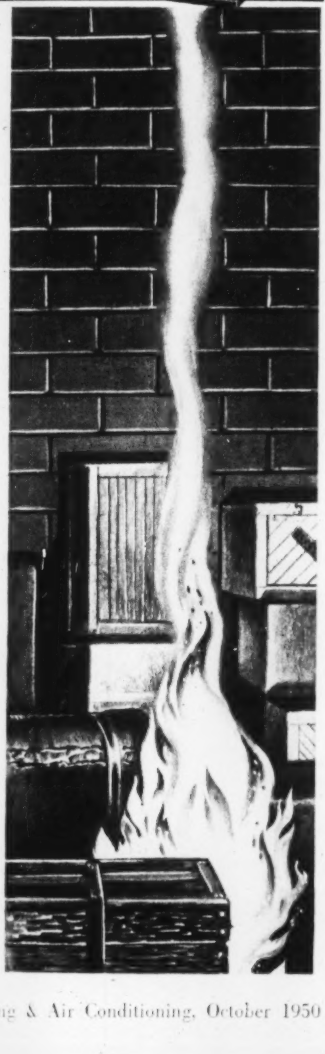
AT EACH FIRE HAZARD POINT

Let C-O-TWO safeguard your property from fire, even if you have a night watchman on duty. With a C-O-TWO Combination Smoke Detecting and Fire Extinguishing System you have an automatic, round-the-clock fire watchman that simultaneously guards each fire hazard point. The first trace of smoke in a protected area is drawn through pipes to a smoke detector. Immediately an alarm sounds . . . then fast, clean carbon dioxide gas fully floods the stricken area . . . the fire is out before it has a chance to spread and cause extensive damage.

Actual fire tests made by the Underwriters' Laboratories, Inc. show that fire detection with this type of smoke detecting equipment is much quicker than other methods . . . because usually there is smoke or smoldering before flames break out.

There is no water damage, no lingering odors with carbon dioxide . . . only damage is that actually caused by the fire itself. Carbon dioxide is clean, dry, non-conducting and non-damaging . . . harmless to finishes, materials and equipment. The fire is out in seconds, with hardly any interruption or commotion.

Remember fire doesn't wait . . . let an expert C-O-TWO Fire Protection Engineer advise you on your fire protection needs now, before fire strikes. Write today for complete free information!

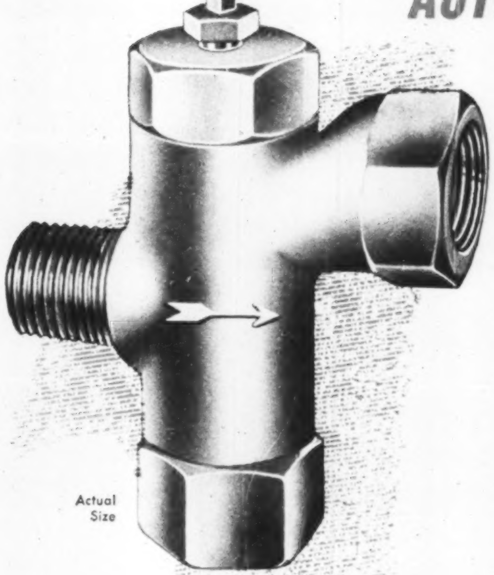


TRADE MARK
C-O-TWO
REG. U.S. PAT. OFF.

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

Stop water line freeze-up with

ALCO METERING AND AUTOMATIC WASTE VALVES

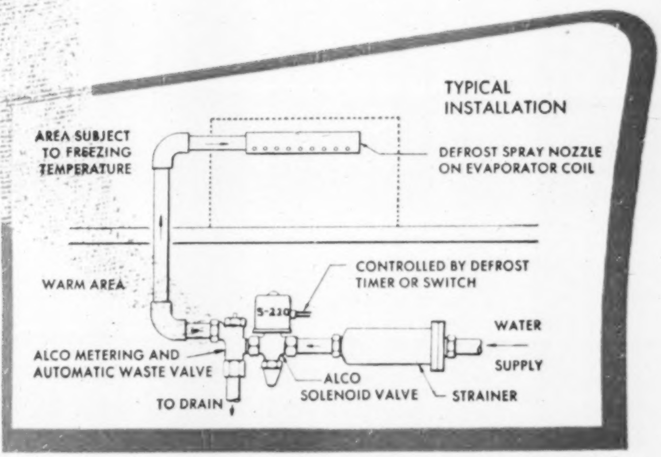

Actual Size

Water supply lines are subject to freezing and damage. ALCO Metering and Automatic Waste Valves provide in one compact assembly:

(1) adjustable metering of flow

(2) automatic waste drainage

Ordinarily used with a standard solenoid valve controlled by thermostat, defrost timer or other means, the ALCO Metering and Automatic Waste Valve contains two spring-loaded check valves which open when the pressure within the valve body drops after the solenoid closes. This allows water in the supply line to drain back through the valve drain port and prevents damage from freezing.


TYPICAL INSTALLATION
AREA SUBJECT TO FREEZING TEMPERATURE
DEFROST SPRAY NOZZLE ON EVAPORATOR COIL
WARM AREA
CONTROLLED BY DEFROST TIMER OR SWITCH
S-220
WATER SUPPLY
ALCO METERING AND AUTOMATIC WASTE VALVE
TO DRAIN
ALCO SOLENOID VALVE
STRAINER
4448

CONSTRUCTION:

cast bronze body, stainless steel springs, brass seat discs, metering stem and packing nut. One size only, with ½" M. P. T. inlet and ½" F. P. T. outlets. Maximum pressure, 200 p. s. i.

Designers and Manufacturers of Thermostatic Expansion Valves, Pressure Regulating Valves, Solenoid Valves, Float Valves, Float Switches.

SEE YOUR ALCO WHOLESALER

25 ALCO

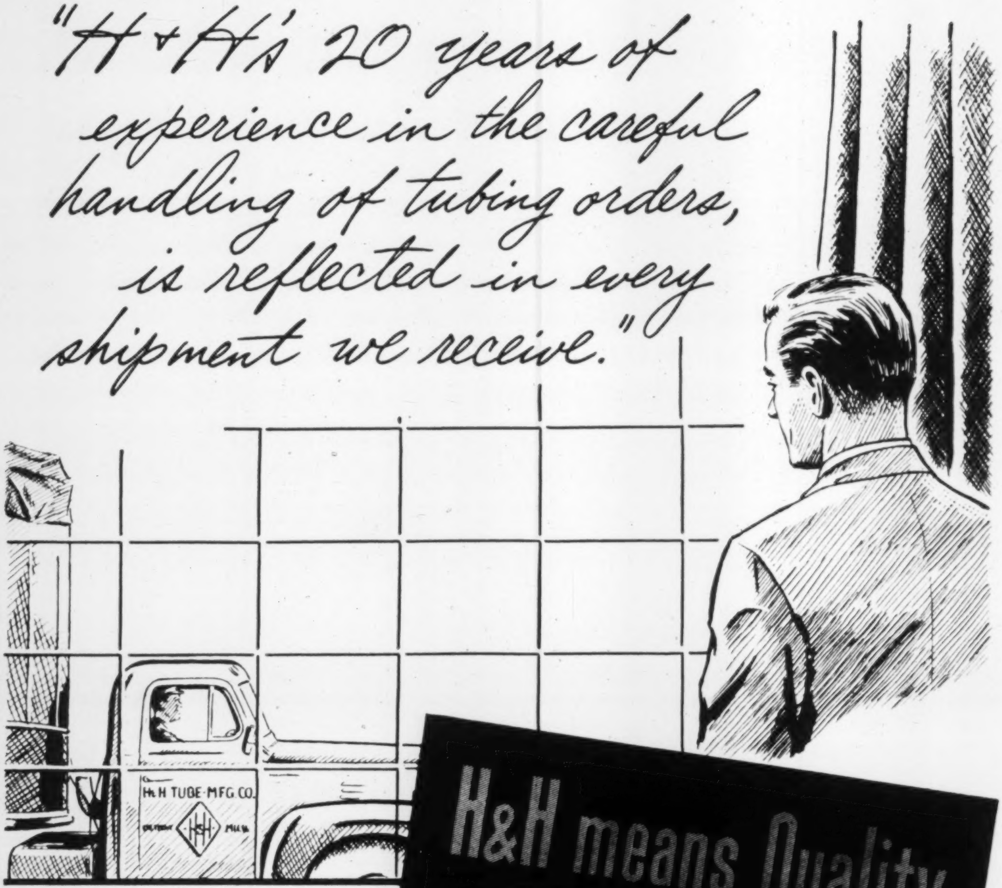
A QUARTER CENTURY OF PIONEERING AND PROGRESS

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

A TYPICAL REPORT:

"H & H's 20 years of experience in the careful handling of tubing orders, is reflected in every shipment we receive."



H&H means Quality
and savings
and Service in Brass and Copper Tubing

Over the past twenty years, H & H has developed sales, production, quality control and servicing facilities that today make quality brass and copper tubing, coil strip and fabricated parts available for your needs. If you agree that it pays to do business with an experienced, well-established, dependable company, why not get in touch with your nearest H & H representative today?

Originators and sole makers of "Metalflo"—the economy tubing

H & H TUBE AND MANUFACTURING COMPANY

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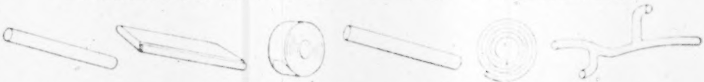


METALFLO · LOCKSEAM · COIL STRIP AND SEAMLESS TUBING · TUBULAR PARTS

On to Philadelphia

. . . for NEW IDEAS!

Striking advances in HEATING, VENTILATING and AIR CONDITIONING equipment for all types of commercial and public buildings, industrial plants, institutions and homes . . . the latest trends and practices — a wealth of new, useful ideas — all are in store for you at the —

10th AIR CONDITIONING EXPOSITION
International Heating & Ventilating Exposition

Over 300 informative, technically-staffed exhibits and demonstrations will afford you unequalled opportunity to see and compare at one time hundreds of new and improved items from complete units to maintenance supplies — to discuss your plans, problems and requirements first-hand with engineering specialists.

Plan ahead NOW to attend this foremost event of its kind . . . to get more valuable information, more progressive ideas, more worthwhile contact than you can acquire in any comparable time or way. Note the date — January 22-26, 1951.

Auspices of the American Society of Heating and Ventilating Engineers.

TENTH
Air Conditioning
Exposition
INTERNATIONAL HEATING &
VENTILATING EXPOSITION
COMMERCIAL MUSEUM, PHILADELPHIA, PA
JANUARY 22 26 1951

MANAGEMENT INTERNATIONAL EXPOSITION COMPANY

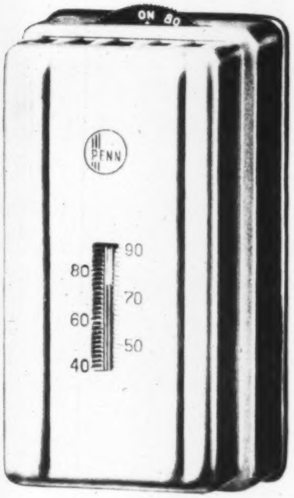
"UNIT HEATERS Need UNIT CONTROL"

That's right! For greater year 'round efficiency, equip *each unit heater* with a PENN heat-anticipating thermostat featuring the *built-in "on-off" switch*. Then, you can have accurate, economical individual temperature control for each department or section of the plant.

The PENN unit heater thermostat is a great fuel saver during winter months. First, through the famous PENN heat-anticipating principle, the thermostat holds temperatures closely to the selected level . . . wide swings and over-runs are eliminated. Second, the "on-off" switch prevents heat from pouring into areas where it's not required. A mere rotation of the dial to "off" position stops heat flow during idle periods . . . or to little-used areas . . . or to areas exposed for long periods to outside temperatures such as receiving or shipping rooms.

This same "on-off" feature permits manual control of fan operation for summer ventilation *without* installing an additional switch. By rotating the dial to "on" position, it causes continuous operation of unit blower whenever desired.

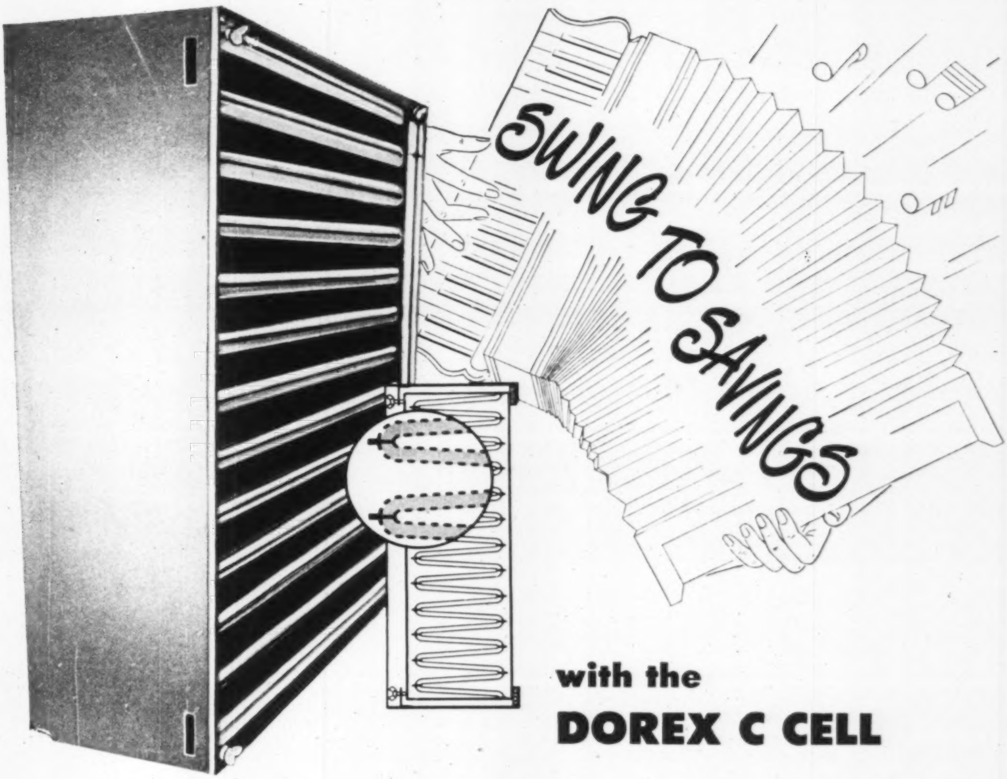
Learn more about this *better control* for unit heaters. Ask your wholesaler or write **Penn Electric Switch Co., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, U.S.A. In Canada: Penn Controls, Ltd., Toronto, Ont.



PENN

AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES



with the
DOREX C CELL

Accordion pleating plays a big part in keeping efficiency up, costs down. When you install Dorex Type C Air Recovery Cells in air conditioning systems and units, the most effective air purifier known—*activated* carbon—is put to work in the most effective way. Accordion-pleated beds expose maximum surface area.

This special Dorex *activated* carbon extracts all gaseous and odorous impurities from the air that passes through it—makes stale air completely fresh and re-usable. This means that the amount of new air that has to be taken in can be reduced by as much as two-thirds. *And the cost of Dorex Air Recovery is only one-fourth the cost of conditioning an equivalent amount of outside air!*

More than 6,000 users—leaders in business everywhere—now use Dorex Air Recovery. Their savings in capital expenditure for air conditioning equipment have been great; and they continue to save millions annually in operating costs. Architects, engineers and contractors have been recommending Dorex Air Recovery for more than 20 years.

Have all the facts about Dorex Air Recovery on file. Mail the coupon today.

air recovery cells

WORKS LIKE A GAS MASK

DOREX

REG. U. S. PAT. OFF.

Air Recovery

W. B. CONNOR ENGINEERING CORP.
Danbury, Connecticut

Air Diffusion • Air Purification • Air Recovery

In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

TRADE MARK "DOREX" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Dept. A-100, Danbury, Connecticut

Please send me, without obligation, full information on Dorex Air Recovery.

Name..
Position..
Company..
Street..
City........................Zone........State........

Humphrey
GAS UNIT HEATERS

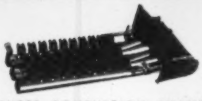
Dependable . . . Economical . . . Efficient

The demand for gas fired unit heaters is increasing steadily because of their many *plus* advantages . . . advantages that include saving of floor space, economical installation and operation, cleanliness, elimination of boilers and fuel storage. Humphrey Gas Unit Heaters are the finest that over 50 years experience in building gas heating equipment can produce . . . when you sell a Humphrey, you sell complete customer satisfaction.

Available in sizes from 65,000 to 200,000 BTU input ratings; Rotor Type available with louvers or duct adapter.

PROPELLER TYPE
Humphrey
ADVERTISED IN
TIME
ROTOR TYPE

ONLY *Humphrey* HAS ALL THESE ········▸ QUALITY FEATURES



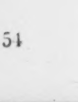
SUPER COMBUSTION CHAMBER—Completely new, all steel with special stainless steel lifetime "dual flame" burner tips.

POSITIVE SAFETY CONTROLS—Baso Safety Pilot shuts off gas in event of pilot outage, Humphrey overload assembly eliminates danger of overheating due to any cause.

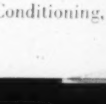
ADJUSTABLE LOUVERS—Horizontal or vertical louvers available . . . easy control of angle at which heat is directed downward at desired level.

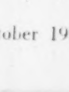
FREE FLOW HEAT EXCHANGER — Heavy gauge steel, welded for strength and gas-tight construction. Large area, streamlined surface, effects rapid transfer of heat. No baffles to impede flow. Requires no cleaning.

GENERAL GAS LIGHT COMPANY
KALAMAZOO, MICHIGAN

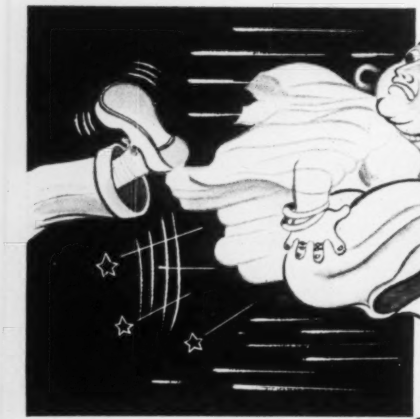

Radiantfires

Circulators


Wall Heaters

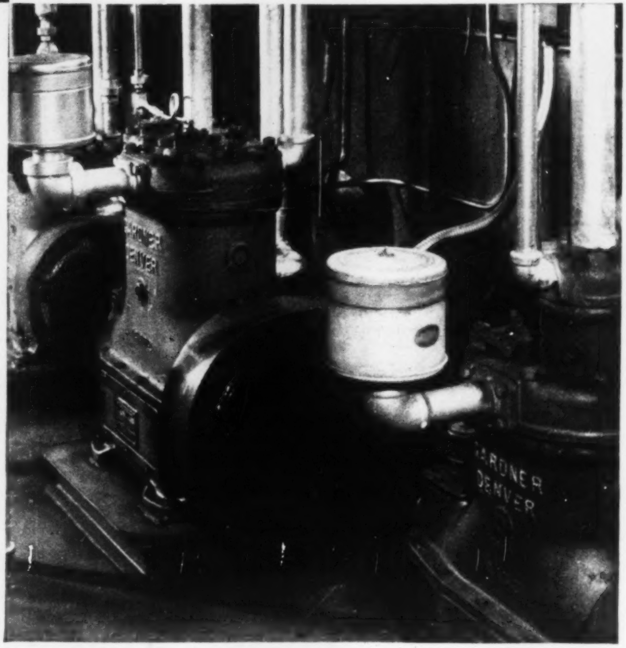

Unit Heaters

FOR PEAK PERFORMANCE
on ALL installations
Buy
SPORLAN
right down the line!
SPORLAN
STRAINER
Catch-All
SPORLAN VALVE COMPANY
St. Louis, Mo.



You don't need a gypsy...

to foretell the future of this compressor!



Gardner-Denver AA Vertical, Single-Stage, Water-Cooled Compressor. Capacities from 32 to 183.6 cubic feet displacement per minute.

Consider the evidence:

Gardner-Denver AA Compressors are known throughout the world for continuous service under all operating conditions.

Look into the design:

Gardner-Denver AA Compressors are built to last, with quality features such as generous bearing areas, extra large water jackets and force feed lubrication.

You can safely predict:

A Gardner-Denver AA Compressor installed in your plant will assure a dependable source of compressed air for years to come — will save you money every year — on both operation and maintenance.

Write today for complete information on AA service records and construction features.

Since 1859

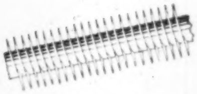
USE COMPRESSED AIR FOR SAFETY CONVENIENCE FLEXIBILITY

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada:
Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

WHICH FORM OF TUBING CAN YOU USE?

Wolverine TRUFIN*?

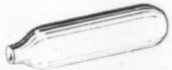


Trufin is the finned tube with the fins integral with the tube itself, thereby capable of withstanding vibration and extreme temperature changes. This tube saves space for you. It wi vide the required surface area in just a fraction of the space demanded by plain tube to meet the same requirements in heat exchangers. Or by utilizing the entire area you have available for tubing, you can substantially increase the efficiency of the operating unit.

Trufin is available in several alloys in many fin heights and spacings, in most popular sizes. Also in bimetal (copper inside, aluminum fins outside). Ask for our reports dealing with heat exchangers.

*Reg. U. S. Pat. Off.

Spun End Parts?



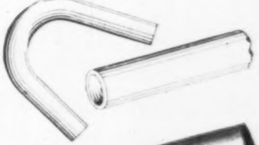
Tube can be formed into a multitude of shapes with economy. For instance, the ends can be spun to a smaller diameter —ending in a taper or in a round end entirely closed or partially closed. The tube can also be made with a bead around the circumference. In a word, the Wolverine Spun End Process offers opportunities for a wide variety of end treatments of tube and can save you the cost of extra parts that you now think seem necessary. And besides, eliminate assembly costs.

Our new brochure, Spun End Tube, is just off the press. Would you like a copy to acquaint you with possibilities for greater economy and efficiency that are within reach just by making a slight change in the design of a part?

Request a copy on your stationery.

Spun End Process is a patented process RE 22465

Plain or Fabricated?



Do you need plain tube of a certain alloy, of a specified diameter and length, to convey safely a particular kind of fluid or gas from one point to another? Does the factor of corrosion present a problem? Do you want the plain tube so you can fabricate it into something else yourself?

Would you rather have us do the fabricating to your specifications from our seamless, nonferrous tubing and ship the finished parts to you? Perhaps you would like to check with our Customer Engineering Service to assure yourself that your fabricating practice is producing the parts most efficiently.

Keep in mind that our business is the manufacture of tubing exclusively. Call on us any time you need information on tubing fabrication.

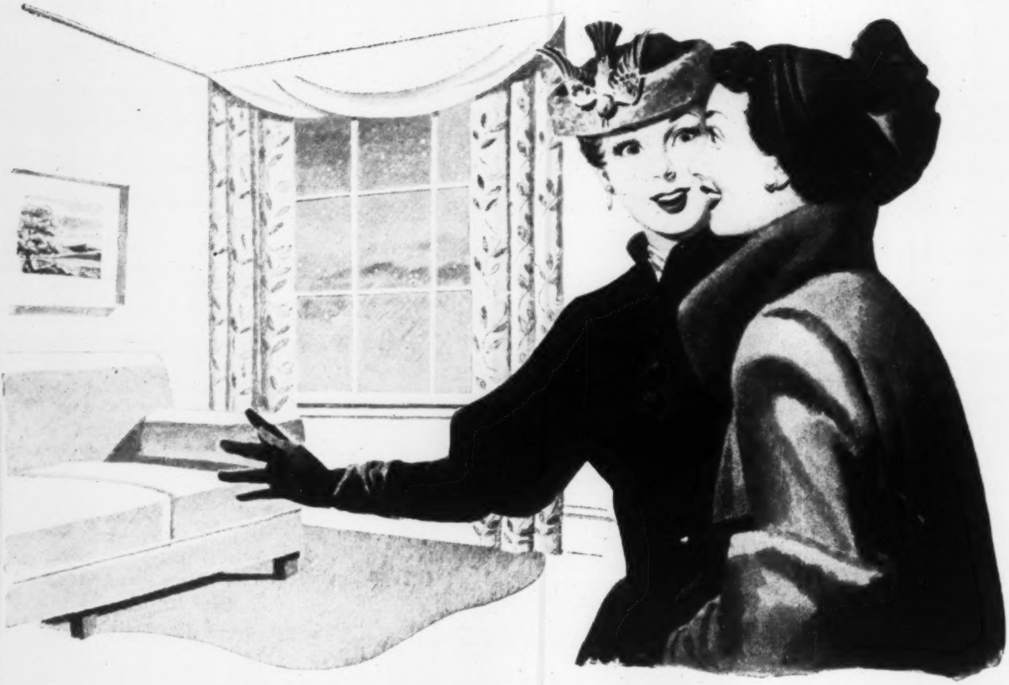
Wolverine Trufin and Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ont.

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated Copper Company
INCORPORATED
MANUFACTURERS OF SEAMLESS, NON-FERROUS TUBING
1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN
Plants at Detroit, and Decatur, Alabama

Stocks Available at All Wolverine Mill Depots:
DETROIT, MICH. • DECATUR, ALA. • HOUSTON, TEXAS
LOS ANGELES, CALIF. • LONG ISLAND CITY, N. Y.

Sales Offices in Principal Cities

"Look – no radiators !"



Steel pipe is first choice for home radiant heat

Imagine the surprise of the "girls" from the bridge club when they walked into their new member's living room. Out of the blustery cold, into the glowing warmth of a beautiful room which, as far as the eye could detect, seemed to have no heating system at all!

Yes, that's the effect radiant heating *has* on folks who have never experienced it before . . . as though the warmth of summer sunshine had been stored up in some magic way and gently released indoors when winter comes.

To bring these pleasant advantages of radiant heating to the home, architects, engineers and heating contractors are utilizing the favorable, inherent characteristics of steel pipe to provide outstandingly successful systems. For they know that steel pipe has not only been *proved* by more than 60 years of comparable service, but, for this new application, includes all the desired qualities of formability, weldability, durability and suitability . . . plus maximum economy!

Yes, for radiant heating there's no question . . . steel pipe is first choice!

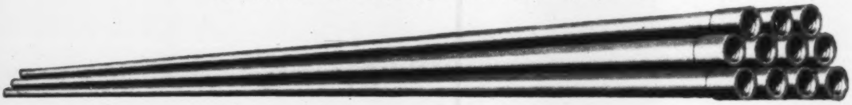
SNOW MELTING, TOO

Sidewalks and driveways can be kept free of snow with modern steel pipe snow melting systems!

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N. Y.



Industrial Hot Water Supply

that "takes no space"!

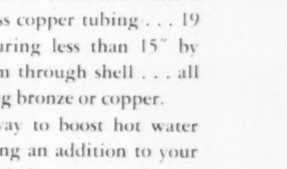
This General Instantaneous Water Heater installation at Nicholson File Company supplies 96 gpm at 125° F. for 12 Bradley wash fountains in the Cutting Dept. washroom.

Think of all the headaches avoided by this compact, simple G F hot water heater that supplies 96 gals. of 125° water a minute. No space problem, because it's mounted on the wall . . . out of the way. No major construction is involved either, because it has no tank, no complicated piping. Installation required minimum of planning, minimum amount of work. And the unit is located near the washroom . . . no long runs of piping, no heat waste.

Maybe you have a similar water heating problem that can be solved as economically and as easily. General Instantaneous Water Heaters supply up to 300 gallons of clean hot water a minute through seamless copper tubing . . . 19 sizes, the largest measuring less than 15" by 120". Heated with steam through shell . . . all waterways non-corroding bronze or copper.

Here's the efficient way to boost hot water capacity without building an addition to your plant or crowding your boiler room. Why not get all the details? Send for new Catalog No. 19. General Fittings Co., A-123 Georgia Avenue, Providence 5, R. I.

GENERAL instantaneous water heaters



General Instantaneous Water Heaters 19 sizes up to 300 g.p.m

Products of General Fittings Co., makers of Tankless and Indirect Water Heaters and Heating Specialties.

Taco's Horizontal goes HY-DUTY

SAME INTERCHANGEABILITY OF FLANGES AND OTHER QUALITY FEATURES OF TACO CIRCULATORS

DESIGNED FOR LONG RUNS, RADIANT PANELS AND OTHER HIGH RESISTANCE JOBS

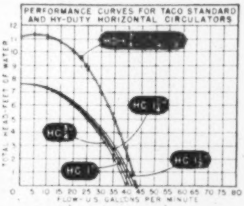
Pumps 20 GPM against 10′ head

TACO
VENTURI
INLET

SAVE MORE MONEY
With Taco Venturi Fittings

You use only one Taco Venturi fitting to a radiator . . . on the return. Use same one on downfeed as you use on upfeed radiators.

IT'S A BIG BROTHER TO TACO'S "HC" STANDARD WHICH PUMPS 5 GPM AGAINST 7½′ HEAD



SEND FOR THIS BOOKLET . . .

Gives accurate engineering for one pipe hot water jobs in easy-to-use tables.

DESIGNING SIMPLIFIED... TACO

Better Heating-Better with Taco

Taco

TACO HEATERS, Incorporated
137 South St., Providence 3, R. I.

It's no time to fiddle!

HEADLINES warn us of the menace of spies and subversive agents. But in every community there is a hazard, largely unrecognized, which may become ready tinder for the ravaging flames of socialism and communism. This is the misconception of everyday economic facts that exist among our young people.

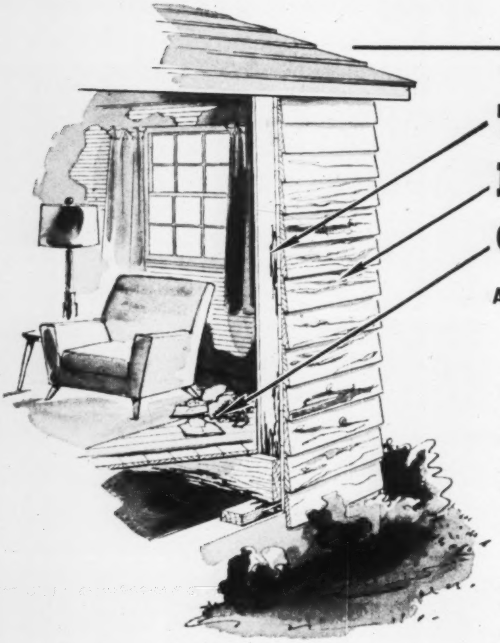
For example, a recent poll among high school seniors shows that the majority of them believe that the owners of business take out for themselves a larger share of the income than is paid to employees. They think the stockholders' average return is 24% of the sales dollar. The truth is that stockholders average less than 3%, whereas over 30% of the income dollar is paid out as wages, pensions and other benefits.

Our young people do not seem to realize that paying dividends is only one function of profits. Far more important today is the need for profit to keep business competitive, and to pay for new buildings, machinery, and other necessary equipment and to provide new and more jobs. Ignorance of this fundamental concept breeds contempt for the system of enterprise that built our country and keeps it strong.

The facts of business must be given to our boys and girls to protect their future. Only business men can supply the facts. As a business leader in your community, it is your responsibility to help clear up such misconceptions. The old story that Nero fiddled while Rome burned must not have a counterpart in America.

The Youngstown Sheet and Tube Company
General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.



Avoid

Timber Rot, Peeling Paint, Crumbling Plaster

Asphalt Paper is Not Vapor Proof—Merely Waterproof

Unventilated walls with ordinary insulations which permit water vapor to seep through, condense and accumulate, can cause considerable damage. More than a million dollars was recently spent in ripping out and replacing crumbling plaster walls in a tremendous brick and steel, nationally known, apartment development in Greater New York.

Vapor, a gas, flows through a wall, including plaster and asphalt, from high vapor density areas to low. Upon reaching a substance colder than its dew-point temperature, it condenses.

"Dew will not form on the walls and ceilings of a well-insulated house. But it may condense in the insulation in the walls or on the siding or sheathing. The insulation and wood then become damp. In time this dampness may cause the wood to rot, and the paint to peel off." U.S. booklet,* "Insulation and Weather-proofing," Page 11, Division of Farm Buildings and Rural Housing.

Multiple accordion aluminum is impervious to vapor and is non-condensation forming. Because of its slight mass, the aluminum sheet on the warm side quickly approximates the temperature of the contacting air; and never falls below the dew-point. Heat flow by inner as well as outer convection is blocked by the fiber and aluminum sheets. The air spaces practically eliminate conduction. The additional aluminum sheets reflect back 97% radiation on the warm side and emit only 3% on the cold side. Extraction of heat from the air by a contacting colder surface, which causes condensation, is negligible.

Because of its low (3%) emissivity, the aluminum sheet on the cold side is always slightly warmer than the cold contacting air, so that condensation on it is not possible. There is no dew-point possible anywhere on or within the insulation.

This construction for walls is available commercially as INFRA INSULATION, TYPE 4 and TYPE 4 Jr. They cost under 7¢ a sq. ft., material with labor, in new construction between wood joists.

THERMAL FACTORS, TYPE 4 INFRA

Down-Heat	**C.064, R15.62**	**equals 5" DRY Rockwool**
Up-Heat	**C.109, R 9.17**	**equals 3" DRY Rockwool**
Wall-Heat	**C.105, R 9.52**	**equals 3 1/7" DRY Rockwool**

VAPOR PERMEABILITY equals ZERO

Multiple Accordion Aluminum and Triangular Reflective Air Cells

INFRA INSULATION, INC.
10 Murray Street New York, N. Y.
Telephone: COrtlandt 7-3833

INFRA INSULATION, INC.
10 Murray Street, New York, N. Y. Dept. H-10

Please send me free, *Government booklet, "Insulation and Weatherproofing."

Name ____________________

Firm ____________________

Address ____________________

☐ Send Price Lists of Insulations ☐ Send Free Sample

THE EDITOR'S PAGES

• Manufacturers of heating, piping and air conditioning equipment used in industrial, commercial, institutional and public buildings have recently received—or will within a few days—copies of the listing sheet for HPAC's Directory Section of such equipment to be published in the January issue. This is the 17th publication of this comprehensive compilation of sources of equipment, the first Directory Section—and the first of its kind in this field—having appeared in our January 1935 number . . . . . It's a big job in our own office to get the listing sheets properly checked and mailed out to the hundreds of manufacturers of equipment involved, and it will be a bigger job when the sheets come back to us to make the necessary additions, deletions and other changes which will assure the accuracy and completeness of the final result . . . . . It's also a time-consuming task we ask of each individual manufacturer, and we extend our thanks here and now to them for the careful attention they give our request for assistance in compiling this Directory Section, which is intended for your use throughout the coming year . . . . . In preparing the new Directory Section, any comment at all you may wish to make on your use of last January's compilation, what you found—or didn't find—in the individual listings, how the information could be better arranged for your convenience, would certainly be helpful to us. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Illinois.

PIPING CODE ASSURES NEW GAS LINE'S SAFETY

Recognizing that the new $11 million natural gas pipe line being constructed in the congested areas of New York City requires the ultimate in safety, designers and contractors have used the American Standard Code for Pressure Piping as their guide in designing "ultrasafety." The line will virtually assure local industries and household consumers against any future recurrence of a fuel crisis.

The line is designed for 350 psi pressure, has a safety factor of five—five times as strong as is normally necessary for highest rated operating conditions. Added safety is given by using pipe with greater wall thickness than is required by the American Standard code. In all cases, the stresses on the pipe are less than those allowed by the code. All valves are of cast steel, although the code permits cast iron to be used. Valves being installed are rated at more than twice the maximum design pressure of the line and are given a factory hydrostatic test ranging from 1200 to 1600 psi depending upon size.

In addition to ultra-strict observance of the code requirements, safety features include the use of electronic fault detectors; glass fiber insulation; magnesium anode anticorrosion protection; and forged steel pipe bends.

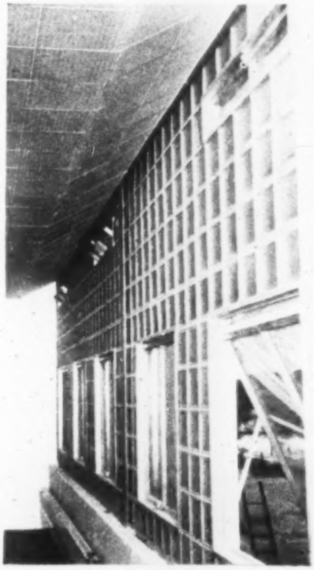
CEILING DESIGNED TO AID AIR CIRCULATION

The acoustical tile ceiling installed in the new Toledo Union Station is recessed near the wall for the purpose of inducing air circulation and affording more daylight. Air entering through the lower windows will circulate upward and exhaust through the upper vents of the glass block wall.

A total of 30,000 sq ft of noncombustible, glass fiber, textured and perforated acoustical tile was installed in the station by Turner-Brooks, Inc.

The station was designed and is being constructed by the New York Central System, under the supervision of E. A. Dougherty, New York Central chief engineer, R. L. Corsbie architect and W. A. Bogert resident engineer. The Duffy Construction Corp. is the general contractor. (Photo courtesy Owens-Corning Fiberglas Corp.)

The acoustical tile ceiling at the new Toledo Union Station is recessed near the wall with the aim of inducing air circulation and affording more daylight



HOW INVENTORS CAN HELP IN CRISIS

How America's inventors can best aid their government in the present time of crisis was a topic of discussion at the 10th anniversary meeting of the National Inventors Council, held in Washington under the chairmanship of Dr. Charles F. Kettering.

The council, a volunteer group of distinguished American scientists and engineers, was created in 1940 to act as a link between American inventors and military and other federal agencies with problems requiring technical solution.

During World War II the council's staff evaluated over a quarter of a million inventive suggestions, some of which, including the magnetic mine detector, played a vital role in military operations.

Periodically, after consultation

PREVENT FIRE . . . . .
SAVE LIVES
FIRE PREVENTION WEEK
OCTOBER 8-14

with the military, the council circulates to interested inventors lists covering inventive problems currently of particular importance. The last list released, for example, included a number of problems relating to arctic operation, such as the need for noncorrosive, extreme low temperature snow melting chemicals; low temperature automotive type batteries and convenient dry battery heaters; rooters for loosening frozen ground; and a portable instrument to give exceedingly sensitive readings of automotive antifreeze condition.

ASTM FORMS AIR POLLUTION COMMITTEE

The American Society for Testing Materials has authorized the formation of a new technical committee on sampling and analysis of atmospheric pollution.

The committee will not consider the problems of specifying limitation of pollution, nor such other related matters as biological and health problems, but will endeavor to develop analytical and sampling test methods as standards.

IF YOU HAVEN'T ALREADY HEARD . . . .

Construction totals for 1950 are expected to exceed the 22.6 billion dollar total of 1949, according to revised estimates of the Construction Division of the U. S. Department of Commerce, and the U. S. Labor Department's Bureau of Labor Statistics. This unprecedented volume of expenditures for new construction is anticipated on the basis of record breaking building activities during the first half of 1950, and indications point to no letdown in the last half. During the first half of 1950 expenditures for all types of new construction ran 17 percent above the like 1949 total.

Industrial and commercial construction, after a three year decline, has also turned sharply upward. For the first 29 weeks of 1950, expenditures for commercial buildings totaled $533,999,000, up 65 percent, and for industrial buildings it was $662,337,000, up 21 percent.

The gas utility industry will spend over $3 billion in the construction of new and expanded facilities in the five-year period 1950-54, according to a survey completed by the American Gas Association. Approximately $2.75 billion of the $3.14 billion total will be spent by the natural gas industry, it is estimated.

Construction and modernization activity in the gas utility industry continued its upward surge in 1949, exceeding the previous record established in 1948. Anticipated construction expenditures for 1950 indicate that another record will be set this year.

PROFIT, VOLUME, ORDERS UP

Net profit of Carrier Corp. (air conditioning, refrigeration and industrial heating) for the 12 months ended July 31, 1950 was $2,483,769 as compared with $1,668,713 for the preceding similar period. Completed business totaled $54,161,991. The comparable figure for the 12 months ended July 31, 1949, was $50,465,798.

New orders were booked in the amount of $53,417,159. The total for the preceding 12 months was $46,155,509. On July 31, 1950, the corporation had a backlog of unfilled orders amounting to $18,179,263, as compared with $16,308,217 a year earlier. These figures are exclusive of a sizeable government contract which has been only partially completed.

OFFERS PLANT SAFETY CONTEST PLAN

A packaged plan showing how to promote interest in safety through contests, with cash prizes paid by the National Safety Council, 425 N. Michigan Ave., Chicago 11, is offered in a 1951 calendar contest kit.

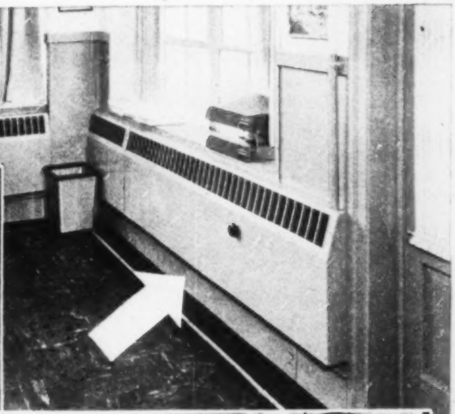
The kit contains a complete instruction booklet showing how to conduct safety contests in plants, monthly contest posters, streamers and contest bulletins for bulletin boards, reproduction proofs and mats of limerick contest cartoons, sample entry blank forms for contests, "spot" anouncements for public address systems or house organs, and copy for announcements.

"QUOTE"

"In the past 25 years, there have been many new developments in the valve and fittings industry. In the fittings field we have seen such things as solder joint fittings, cast and wrought; silver brazing fittings, inserted ring and capillary types; butt welding fittings and the welding neck flange.

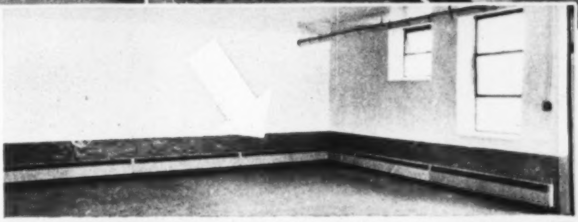
"In the valve division there are the lubricated gate valve; energized lubricant for lubricated plug valves; welding ends, breech-lock and pressure seal bonnets; impactor handwheels; valve operating mechanisms which close a valve with micrometer-like precision and having electric, air or hydraulic motive power.

"In the metallurgical field, the industry has also played a major part in developing the materials which it uses—such developments as nitrided valve seats, stellite and colomonoy hard surfaces, alloy steels such as carbon molybdenum, 4-6 chrome, and 18-8 stainless steels. We have also come to undertand such phenomena as creep and graphitization, and as we turn the corner into the next 25 years, we already see new developments in sight. Nodular iron will perhaps be the first. Each new product has brought with it the need for applicable standards to facilitate mass production and serve as a basis of understanding in their distribution and proper usage."—L. W. Benoit, executive secretary, Manufacturers Standardization Society of the Valve and Fittings Industry, quoted in an article, Valve Industry Celebrates 25 Years of Standards, published by the American Standards Association.

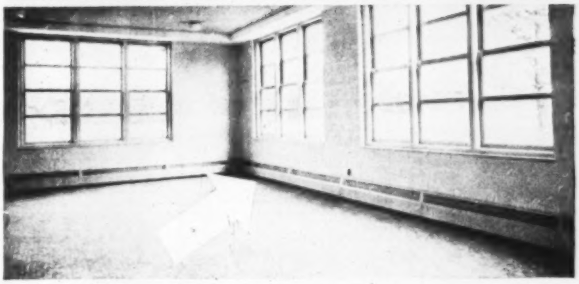


Webster Walvector in office of Mulholland-Harper Company, Philadelphia. Installation by contractor Herbert Baker & Co.

Webster Walvector in new office building for New Jersey State Highway Department. Note supply and return risers; location of Walvector trim piece connectors immediately below window mullions, facilitating installation of office partitions. A Webster Moderator Steam Heating installation, Micklewright & Mountford, Architects, Runyon & Carey, Consulting Engineers, Philip S. Slack & Company, Heating Contractors.



Unheated basement room made available for parochial school classroom use. Webster Walvector in St. Robert's School, Chester, Pa. heats added room with hot water through heat exchanger, without change in main steam heating plant. Modernization installation by heating contractor John A. Morgan, Chester.



Walvector in Norfolk, Va., Catholic High School Lunchroom, Gleeson & Mulrooney, Architects, T. David Fitz-Gibbon, Associate Architect, M. G. Flurer, Consulting Engineer, Coley & Petersen, Heating Contractors.

SOLVES DESIGN PROBLEMS

Webster Walvector, the new idea in wall radiation, is daily solving engineers' heating design problems in new buildings and in modernization.

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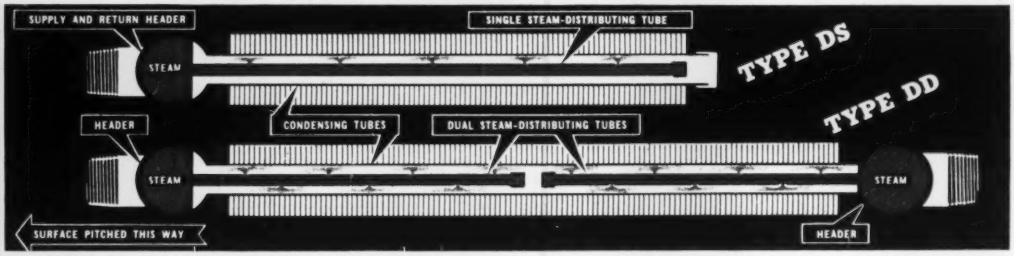
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CONDENSING TUBES
DUAL STEAM-DISTRIBUTING TUBES
STEAM
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TYPE DS SURFACE: Single supply header; single steam-distributing tube inside each condensing tube, for normal heating and ventilating applications. For installations requiring more uniform discharge temperatures, Type DS Surface with DUAL steam-distributing tubes in finned lengths up to six feet.

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"Open for Discussion"

• Do you have something you'd like to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to express your views on some other matter of interest to heating, piping and air conditioning engineers or contractors? We follow here the custom at engineering society meetings of providing an opportunity for discussion following presentation of a paper. You are invited to participate. Just address your remarks to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

VAST POSSIBILITIES FOR EVAPORATIVE COOLING

I was very interested in reading Frank W. S. Hutton's article on evaporative cooling in the July issue of HPAC, mainly because I have spent several months of my graduate study at the University of Wisconsin doing research work on that subject.

I definitely agree with Mr. Hutton about the vast possibilities for the use of evaporative cooling, especially in relatively dry climates.

While I was working on research for my M.S. degree, I experienced difficulty finding enough published technical material on evaporative cooling. For instance, I could locate hardly more than 10 articles on this subject in technical magazines. In most air conditioning textbooks, only five or ten pages are devoted to the treatment of evaporative cooling with very little, if any, practical applications mentioned. This, I believe, is the main reason why evaporative cooling is not occupying the place it deserves among other air conditioning methods.

Engineers active in evaporative cooling should devote part of their time to familiarizing their colleagues, and especially consulting engineers, with its various features, as did Mr. Hutton in his article. This should not be hard to do for people who spend a lifetime working with a certain subject. Also, engineers who have had first-hand experience with evaporative cooling equipment should not hesitate to make public their reaction to its use, in order to guide others who are not very sure what results to expect.

Mr. Hutton mentioned only one way of two stage cooling, by-passing outside air over a water coil cooled to the wet bulb temperature of the air by evaporation. In multi-stage evaporative cooling, it would also be possible to use the following procedure: In the first stage, reduce the dry bulb temperature of outside air to within a few degrees of its wet bulb temperature by evaporative cooling. Then, carry this air through a plate type heat exchanger, making it cool *sensibly* a counterflow of outside air. The latter air can either be supplied to the space that needs cooling or used to cool further another blast of outside air. This procedure can be repeated as often as needed, resulting theoretically in air as cool as the dew point of outside air. However, the cost of going too far in applying this idea is prohibitive. In most localities, one application of this procedure would be enough for comfort.

I believe that direct evaporative cooling, using a wet pad, provides for cleaning the air satisfactorily, as the tiny particles of impurities suspended in the air, which have negligible diffusion velocities compared to that of the air particles due to the former's high molecular weights, will be deposited on the wet pad and carried away by the running water, leaving the discharged air free of impurities.

When Mr. Hutton referred to two stage cooling units, he did not clearly state whether any such units are on the market. As far as I have been able to determine, currently available evaporative cooling units are of the direct, single stage type. However, I would appreciate any information to the contrary. I would also like to know who manufactures the centrifugal units mentioned by Mr. Hutton.—Albert S. Haron.

HOSPITAL A.C. REQUIRES SKILL AND CARE

The comments by Lester T. Avery and Gerald C. Dittman in the September HPAC, on my article about air conditioning hospital operating rooms, have been noted. I appreciate the remarks by these well-known engineers, and will welcome other comment. The questions asked are well taken.

The purpose of my article was to call attention to the fact that the design and installation of air conditioning in a hospital — and particularly for the surgical suite — requires great care and study, and that ordinary design and construction practices used in other applications are not always adequate.

If pointing out existing hazards is "trying to throw a scare," I am rightfully accused. Post-operative infections are frequent, and every surgeon is constantly searching for their causes. The fact that contaminated air from air conditioning equipment has not been heretofore suspected, is no proof that this has not been a contributory factor (malaria existed many years before the mosquito was suspected.)

In the case I mentioned in my article, the facts are:

1) Post-operative infections increased after the air conditioning equipment was installed.

2) The air stream was found to contain, first soot and later a chemical compound in a finely divided state.

3) Bacteriological examination, made by experts, showed that these particles in the air stream carried infectious micro-organisms.

The logical conclusions formed from these facts were that the defects in the air conditioning system were directly responsible for the increase in post-operative infections.

The first trouble was caused by soot that bypassed the filters. This emphasizes the need for the most careful workmanship on the installation. (Incidentally, the writer had nothing to do with the original installation). The installation, as made, was equal to that to be found on many air conditioning jobs. On a store, theater or office job, this would probably have been considered satisfactory. The quantity of foreign matter which was carried into the air stream was relatively small, and would not be detected in an ordinary installation, but in the surgical suite it was dangerous.

The second cause of trouble came after the humidifiers were placed in operation. This was not caused by condensation in the discharge duct, but by direct chemical action between the moist air and exposed inner surface of the discharge ducts. These ducts were insulated and concealed in the plastered walls and ceilings.

The water used in the humidifier was taken directly from the city mains. This city has long been famous for its water, and thousands of people have visited the various health institutions there just to drink and bathe in this water. There is no question that it is as potable and safe a water for human consumption as any to be found in this country. However, it contains a high percentage of minerals, including more than 100 ppm of sulphates.

COVER PHOTO

We are indebted to The Detroit Edison Co. for the photograph on our front cover this month. Originally appearing in that company's publication, the Synchroscope, in a picture story on the Detroit Edison's central heating department, it shows some of the piping carrying steam from the Beacon heating plant to the underground mains which supply customers. The pipes are arranged at an angle to save space.

These sulphates vaporized into the air stream reacted directly with the copper duct, forming copper sulphate, commonly known as blue vitrol. The examination showed that the entire inner surface of the duct was coated with this greenish blue substance, which flaked off readily, and was carried into the operating rooms by the air stream. Each flake carried a large number of infectious micro-organisms. I am sure no one will contend that this air conditioning system was not a hazard to the patients.

It should be particularly noted that the difficulty with this installation in no way reflects on the use of this metal for duct construction. With any other water, the situation might well, of course, be reversed. It just happened that because of the peculiar mineral content of this particular water, it reacted unfavorably with the duct metal. The point made in my article was that, on an operating room installation, even the quality of the water used for humidification had to be considered to avoid difficulty and this would be true no matter what duct material were used.

Nor would bacteriologists and surgeons agree with Mr. Dittman's statement that "water safe for drinking can not contaminate operating rooms." I grant that the case I used as an example involved an association of unusual conditions, but this case certainly points out the dangers of inadequate study on the design and insufficient care on construction. Here the action was rapid and the trouble was discovered in a short time.

What about more hidden dangers? Infectious bacteria are not carried by clean air, but every bacteriologist will verify the fact that these micro-organisms are ever present in the atmosphere, adhering to the most minute particles of dust or other solids. Efficient air filters will remove most such solids when functioning properly, but some positive and continuous method must be used to keep them clean. It can readily be seen that a dirty filter will be highly contaminated and will provide an incubation medium, and thus will be a hazard rather than a protection.

Dangers lurk in other parts of the equipment. Particles of rust, scale, paint, oil and grease may get into the air stream. As the equipment is not sterile, all of these particles will be contaminated.

As shown in my article, the humidifier is second only to the filter as a possible source of trouble. Domestic water supplies vary greatly in their chemical and bacteriological analysis, yet most of these will pass the tests as potable for human consumption. When this contamination is vaporized into the air and then forced into the open incisions of patients on the operating table, direct contact with the blood stream is made. This is a serious hazard to the patient. All other water and equipment used in the operating room is sterilized.

As stated in my article, air conditioning in areas where explosive anesthetics are used is necessary to reduce the danger of explosions, yet the use of this type of equipment has been shown to create other hazards. Due to the dangers of explosions without controlled humidity and temperature, the use of air conditioning equipment may perhaps be classified as a "calculated risk." It certainly follows that such installations *must* be carefully designed, the very best equipment obtainable used, and the installation made with the greatest skill and care to reduce this risk — which was the entire point of my article. — R. A. Phelps, Engineer for hospital design, construction, maintenance and operation.

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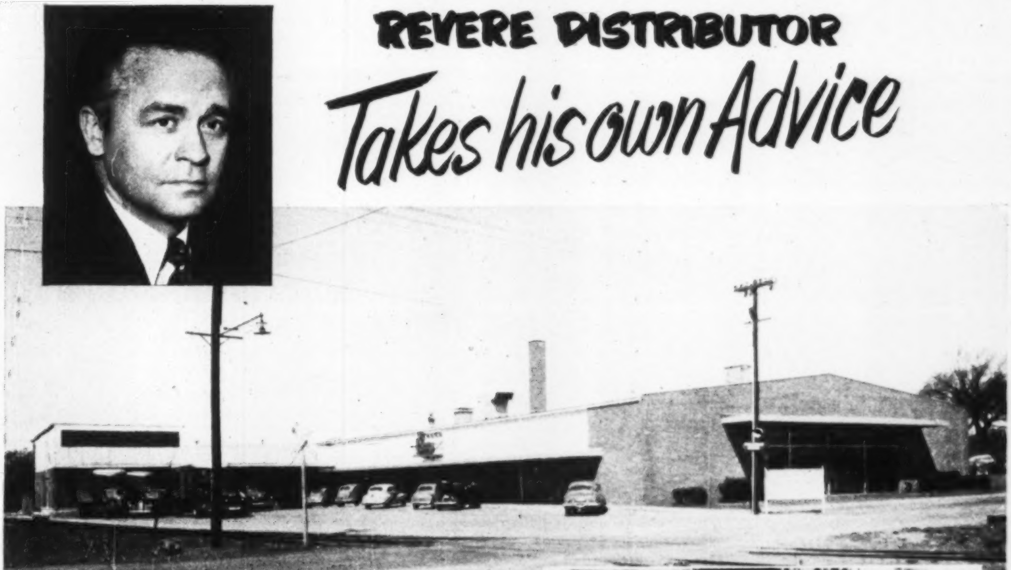
Takes his own Advice



...Harry Cooper Supply Co. installs 16,700 feet of Revere Seamless Copper Water Tube for Radiant Panel Heating in its New Office and Showrooms.

For over 15 years Jack Cooper, President of the Harry Cooper Supply Company, Springfield, Mo., has been advising his customers to use Revere Copper Water Tube and other Revere products. He has learned from the many contractors he has sold how it performs . . . its fine record of service. So when he was planning the heating system for his new office and showrooms he picked Revere Copper Water Tube to do the job.

Those who have used Revere Copper Water Tube will tell you that the long lengths of Revere Copper Water Tube make it a real time saver on any radiant panel heating job and that fewer tools are needed to form radiant panel heating coils. Long lengths also mean fewer joints, while light weight simplifies handling. Revere Copper Water Tube cannot rust or rot and has high resistance to corrosion. This means long life. Joints are quickly and easily made with solder fittings, keeping installation costs surprisingly low.

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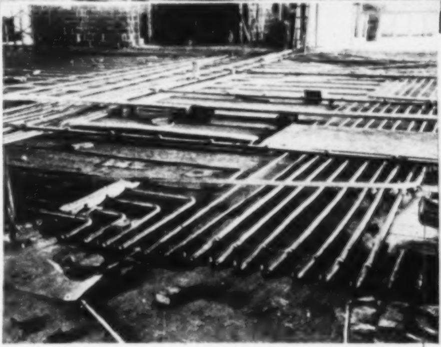
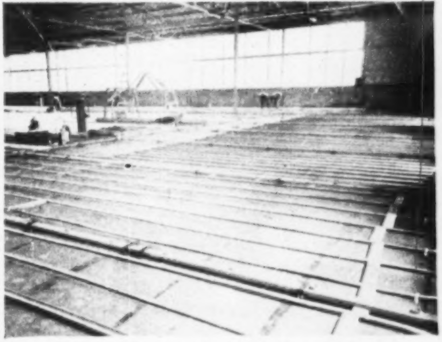
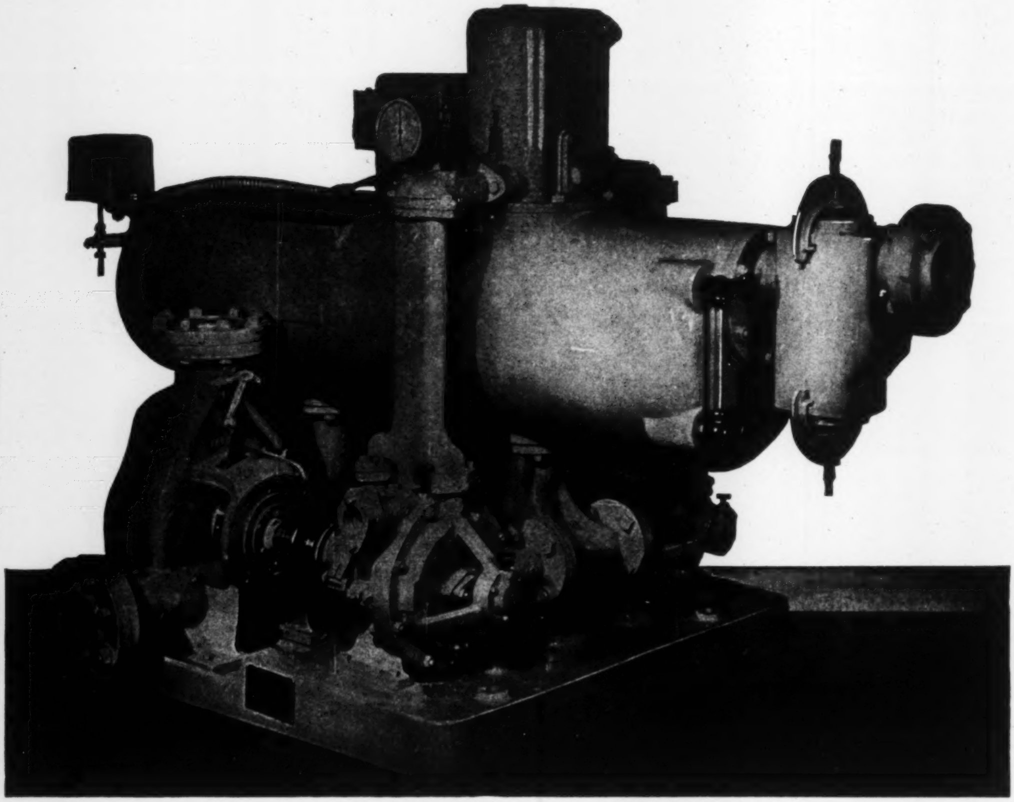


OVER 3 MILES of Revere Seamless Copper Water Tube was used in the radiant panel heating system recently installed in the new office and showrooms of The Harry Cooper Supply Co., Springfield, Mo. Sizes ranged from ¾" to 2".



EVEN, RELIABLE HEAT is assured in all parts of this office by these radiant panel heating coils which were set in a concrete floor slab. Made of Revere Copper Water Tube, coils were easy to bend, needed few fittings, were light to handle. Area of floor panels measures 17,000 sq. ft. Architects, Hawkins & Esterly; Genl. Cont., Chapman & Bramer; Heat. Cont., Bowman & Drussa Plumbing & Heating Co.; Plumbing Cont., Central Plumbing & Heating Co., all of Springfield, Mo.

Where Heat Must Not Fail—Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is entirely independent of electric current failure, and continues to operate as long as there is steam in the system.

More than that, the Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump.

Greater savings still are effected by the Vapor Turbine in the system, for the reason that this pump operates continuously. It is the only pump that can do this with economy. Continuous operation means uniform circulation, and uniform circulation saves steam.

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Applying Standard Equipment To Heat Unusual Building

OSCAR J. CAMPIA, partner in the firm of Hayden, Harding & Buchanan, consulting engineers, describes the unconventional applications of conventional heating methods to the serpentine-shaped Senior Dormitory building at the Massachusetts Institute of Technology. The unusual and controversy-creating design of the structure was used to take full advantage of its site, gives each student's alcove a view of the river

PEOPLE IN CAMBRIDGE are likely to argue with the adage, "There is nothing new under the sun," when they gaze at the Senior Dormitory at the Massachusetts Institute of Technology. Designed by the internationally famous Alvar Aalto, it takes full advantage of the site along the Charles river and this serpentine-shaped building has caused much controversy about its form.

For the heating and ventilating engineer, however, there is no debate as to the value of the project in furnishing information on adapting conventional equipment to unique architectural situations. In fact, the problem at MIT often approached that normally found on shipboard installations.

Steam Connection at Nearby Building

The main boiler plant generates high pressure steam for the numerous local and remote buildings belonging to the Institute. One of these buildings, the Graduate House (approximately 800 ft northeast of the new dormitory) had steam and return connections of ample size to handle the additional 10,500 lb per hr of steam required for the new dormitory.

Both supply and return lines are carried in underground concrete conduits that connect the Graduate House and the new dormitory. The high pressure steam supply is insulated with double-standard thickness magnesia pipe covering and the condensate return with standard thickness. The right-of-way for the new underground conduit was narrow and restricted by numerous existing underground services which

The serpentine shape of the Senior Dormitory at MIT, used to take full advantage of its Charles river site, required ingenuity in design of the heating and ventilating services prevented installation of expansion loops. Expansion was provided for by double expansion joints made of copper and with sleeves of monel. These joints are accessible for periodic inspection because they are installed in manholes which were designed for future changes in the conduit routing. Drainage of the conduits is accomplished by automatic sump pump ejectors located in the manholes, operated by tie-ins to the high pressure steam main.

From the conduits, the lines enter the maintenance room of the new dormitory. Here the steam is immediately put through two parallel reducing valves, reducing the pressure from 185 to 70 lb. Because of the large variation in the overall steam requirements, these valves were selected so that one delivers one-third the maximum load of the building and the other two-thirds. After being metered through a mechanical recording flow meter, the steam, at the reduced pressure, goes into a 70 psi distribution header from which connections are taken off and the pressure is further reduced as required for the various building services.

Steam for domestic water heating is taken from the 70 psi steam header directly to the hot water generators and the instantaneous water heater for the dishwasher. Each hot water heater is provided with a combination pressure reducing and temperature control valve to reduce the pressure to 10 psi. Three hot water storage tanks with built-in heating coils have a recovery capacity of 1000 gph and heat the water from 40 to 140 F. The instantaneous heater for the dishwasher has a capacity of 1200 gph, heating the water from 120 to 190 F.

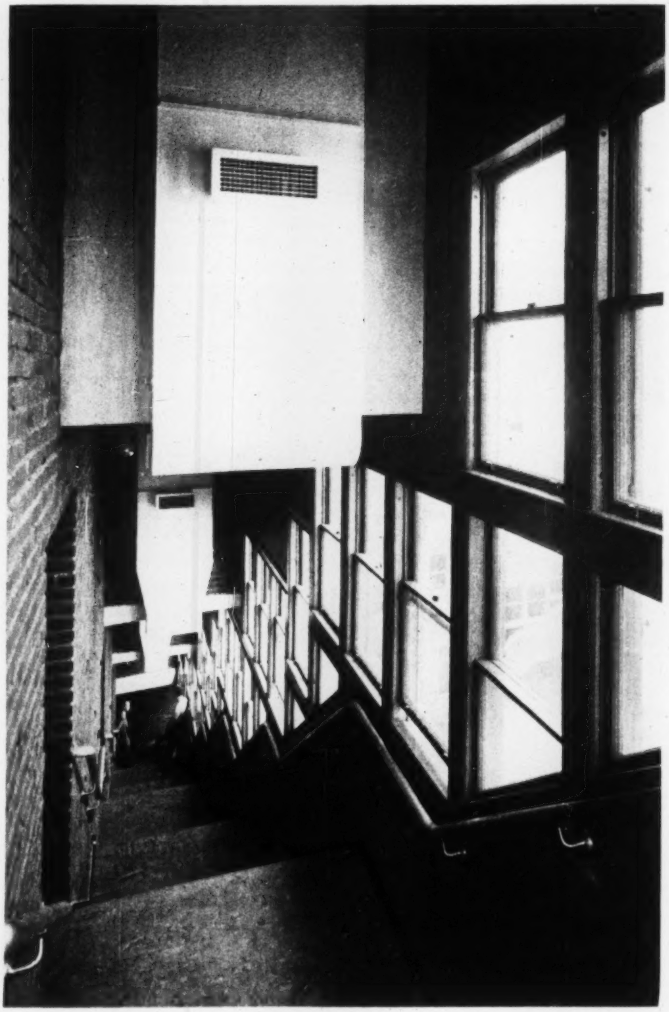
A 10 psi constant pressure steam main was run at the ground floor ceiling from the pressure reducing stations to various zone control valves which feed risers to the convectors and finned radiation on the upper six floors. The same 10 lb pressure mains feed the various outdoor air supply units and the convertors for the dining room hot water heating system.

Steam at 30 lb is taken off to supply the various equipment in the kitchen area.

Up to this point, the system is quite conventional. However, due to the unusual shape of the building, all steam and return mains required special designing in order to avoid other service conduits and piping and still be kept within the confines of the corridors without interfering with the headroom.

The heating system required separation into four zones: northeast, southeast, southwest and east. Each zone is regulated by an outside weatherstat operating a zone control valve.

Unique in their design are the rooms with the view of the river — the students' quarters. All furnishings were specially built-in to fit the various room shapes. Likewise, the heating equipment had to be adapted to blend with the interior decor. Standard sloping top wall convectors were selected as the basis. Then spe-



The cantilever stairs reach upward and outward toward the extreme ends of the building on either side of the main entrance lobby. A fan and blast coil heating system, with the duct work at the ceiling and following the downward slope of the stair well, serves this area

Unique in design are the students' quarters, which view the river. The furnishings were specially built-in to fit the various room shapes

cial extension pieces were designed to provide a continuous flush surface between pilasters. These extension pieces had to follow the contours of the convectors and the room. They had to be easily removable to provide access to the convector piping. In the many stair halls and restrooms, the main lobby and lounges, standard recessed convectors are used.

Three Heating Methods Used

Within this one building there has been utilized steam, hot water and warm air to satisfy the various heating requirements. Again, the design of the building governed in part the type of heating system to be installed. For example, a typical one pipe hot water system had to be installed in the main dining room because there was no basement beneath this section of the building to facilitate steam return mains. In the dining room, heat is provided by finned radiation encased below the vast expanse of windows. Completely screened from view, these units thoroughly blanket these exposed areas. Warm ventilation air supplied through grilles in the ceiling supplements the radiation to give the diners complete comfort in the coldest of weather.

Blast System for Cantilever Stairs

Reaching upward and outward toward the extreme ends of the building on either side of the main entrance lobby are the cantilever stairs. By incorporating this type of stair in his plans, Aalto gained additional room space for each of the intervening corridors and alcove areas. Heating this area was extremely difficult because of the numerous windows and the type of concrete construction required for the cantilever stairs. However, a fan and blast coil heating system has proved quite satisfactory.

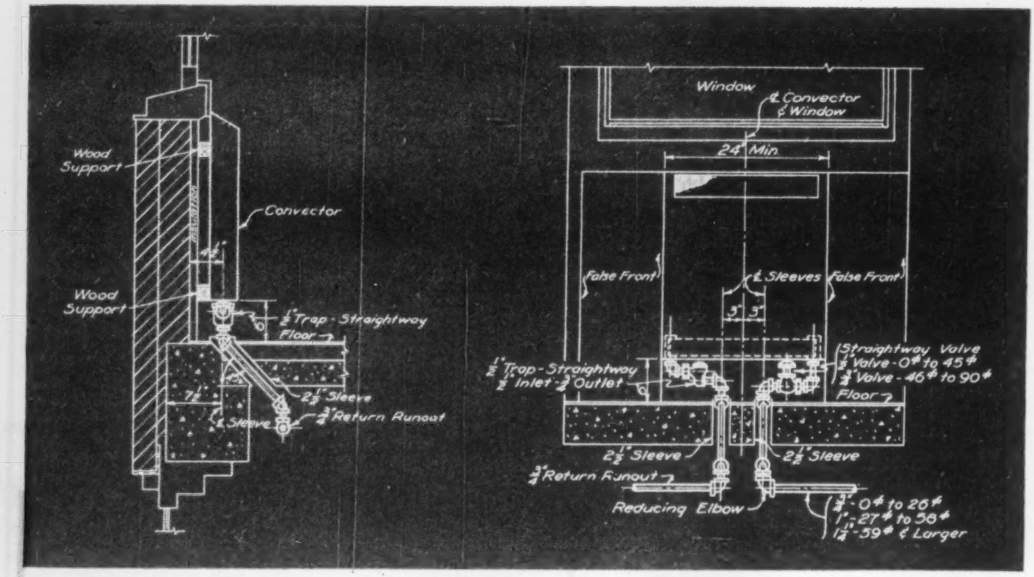
The duct work for this system was located at the ceiling and follows the downward slope of the stair well. The three units that serve these areas are located in penthouses on the roof. This equipment gently but positively replaces some of the air exhausted from various adjacent toilets in addition to maintaining these areas at a minimum temperature at 65 F. This control is maintained by a preheater ductstat located on the leaving side of the primary coil and room thermostats which control steam supply valves to the secondary or booster coils.

Centralized Equipment Simplifies Service

Simplicity was the goal in designing the heating and ventilating system. Simplicity without sacrificing efficiency had to be achieved to keep costs as low as possible. As a result, all main operating equipment was housed together in logically functional areas. Centralizing equipment in such a manner simplifies the service or maintenance problems and, in addition, provides more room required for other needs.

In the new dormitory, six fan rooms, three on the roof and three in the basement, house all the ventilation and indirect heating equipment. The outdoor air supply units were factory built complete with heavy steel casing, double width fans, nonfreeze heating coils, electric

Heating equipment had to be adapted to blend with the decor. Standard sloping top wall convectors with special extension pieces to provide a continuous flush surface between pilasters are used



Typical piping connections for the bedroom convectors

motors, adjustable V belt drives and air filters. Several of these units are located in the basement fan rooms and supply ventilation and make up air to the dining room, lounges, broadcasting room, lobby and inside corridors. Much of this air is exhausted to the outside by fans located in the fan rooms on the roof.

The exhaust system follows conventional procedure, with air flowing from the occupied areas into the corridors to the toilet spaces, and then venting through the roof. However, space limitations at the sixth floor ceiling prevented running duct work from remote duct shafts to roof fan rooms. Therefore, to compensate for this, the arrangement of remote toilets on each floor into three groups allowed the use of a central ventilation shaft from the roof to the first floor in each case. Duct work on each floor runs to the vertical shaft and a roof type, non-overloading centrifugal fan exhausts the foul air.

How Equipment Is Controlled

Careful control of equipment in a building of this size is a primary requirement. Fortunately, the design of the building and the heating and ventilating system lent itself to simplicity in controls. An automatic temperature control system for the student living quarters is divided into four zones. Each zone is electrically controlled and is of the continuous-flow type, consisting of the following:

1. An outside weatherstat controller to vary the steam flow to its respective zone according to outside temperature, wind velocity and solar radiation.
2. A pressure panel located on the system side of each zone valve maintains a given pressure within the zone as called for by the outside weatherstat control.
3. An electric modulating valve set up to allow for variable lifts.
4. A main control panel located in one of the basement equipment rooms enables the operator to spot-check his equipment in short order. Pilot lights, indicating the zone control valve positions, all necessary rheostats, switches, time clocks and special devices to provide for automatic night operation, morning pick-up and day-time requirements, round out the electrical system of control.

These, then, were the various problems and ways they were worked out for the new senior dormitory. The requirements were not unconventional in actual design but were unusual with respect to application because of the serpentine shape of the building.

[Photos—Ezra Stoller—Pictor.]

HUMAN TOLERANCE TO EXTREME HEAT

One of a new group of reports released last month to the public by the Air Force through the Office of Technical Services of the U. S. Department of Commerce, covers studies of human tolerance for extreme heat. Findings on heat tolerance include the observation that men previously conditioned to extreme heat by exposure to relatively high heat have greater resistance; and that an increase in humidity is equivalent to an increase in heat in diminishing human resistance.

PERFORMANCE TYPE BUILDING CODE

A "performance type" building code prepared by the Building Officials Conference of America, Inc., 51 E. 42nd St., New York 17, has been published for national use by communities which are principally residential in character including the usual civic, commercial and educational buildings essential to community life.

Brazed and Soldered

JOINTS FOR PIPING

HERE'S PRACTICAL, authoritative information on brazed joints, soft soldered joints, types of lead welded joints, and joints between dissimilar metals for pipe and tubing, supplementing other articles which have been published in recent months on the general subject of welded piping for industrial use

SOME FORM OF the lap or shear type joint generally is necessary for brazing of connecting pipe to permit capillary attraction, which is a factor. Square-groove butt joints may be brazed but the results will be unreliable unless the ends of the pipe or tube are prepared accurately, i.e., plane and square, and the joint aligned carefully as in a jig. High strengths may be obtained with butt joints if properly prepared and brazed.

The alloys generally used in brazing exhibit their greatest strength when the least thickness of the alloy in the lap area is used; thin alloy sections also develop the highest ductility. For brazing ferrous and nonferrous piping with silver and copper-base brazing alloys, the thickness of the brazing alloy in the joint should be 0.003 to 0.006 in. Thicknesses less than 0.003 in. will make assembly difficult, while those greater than 0.006 in. will produce joints having lowered strength. The brazing of certain aluminum alloys is similar in most respects to the brazing of other materials. However, joint clearances should be greater because of a somewhat more sluggish flow of the brazing alloys. For aluminum, a clearance of 0.005 to 0.010 in. will be found satisfactory.

The length of lap in a joint, together with the shear strength of the alloy employed, are the principal factors determining the strength of a brazed joint. The shear strength may be calculated by multiplying the width by the length of lap by the shear stress of the alloy used. An empirical method of determining the lap distance is to take it as twice the thickness of the thinner or weaker member joined. Normally, this will give adequate strength, but in cases of doubt the fundamental calculations should be employed.

Brazing Fittings Available

Generally, such detailed determinations are unnecessary for brazed piping, since commercial fittings are available in which the length of lap is predetermined at a safe value. One such fitting for brass and copper pipe is made of cast brass. A bore of correct depth to accept the pipe is provided and midway down this bore is a groove into which, at the time of manufacture, a ring of copper-silver-phosphorus brazing alloy is inserted. Since the alloy is preplaced, separate feeding of brazing alloy by hand is generally unnecessary.

Another type of brazing fitting available for pipe is provided with a simple bore of correct diameter and depth. Brazing with this fitting requires feeding of the alloy from a hand-held wire or strip. This fitting is available in brass and malleable iron, the former for use with copper and brass pipe, the latter with steel and wrought iron pipe. In the case of the brass fitting, the copper-silver-phosphorus or the copper-phosphorus type of brazing alloy is employed with copper and brass pipe. For malleable fittings with ferrous piping the brazing alloy should be of the silver-copper-cadmium-zinc type. Brass filler metal (60 percent Cu, 40 percent Zn) of the type commonly employed in braze welding may also be used with these ferrous fittings and pipe.

Cleanliness of the brazing area is an important consideration in brazing pipe joints. Therefore the pipe and fitting must be thoroughly cleaned with steel wool, sandpaper, emery cloth or with a power wire brush. Following the cleaning, brazing flux suitable for the brazing alloy to be employed must be applied to both the fitting and the pipe in the braze area. After assembling the cleaned and fluxed pipe and fitting, heating may be accomplished with

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The chapter on industrial piping of the new third edition of the American Welding Society's Welding Handbook—from which this material has been taken by special permission—was prepared by a committee consisting of D. H. Corey, The Detroit Edison Co., chairman; A. N. Kugler, Air Reduction Sales Co.; J. D. Mattimore, Tube Turns, Inc.; J. Hall Taylor, Taylor Forge & Pipe Works; H. Weisberg, Public Service Electric and Gas Co.; and C. C. Zimmerman, Benjamin F. Shaw Co.

an oxyacetylene flame or other flames that will provide the necessary heat and temperature for effecting the melting and flowing of the brazing alloy. Chapter 22 of the AWS Welding Handbook contains more detailed information on brazing.

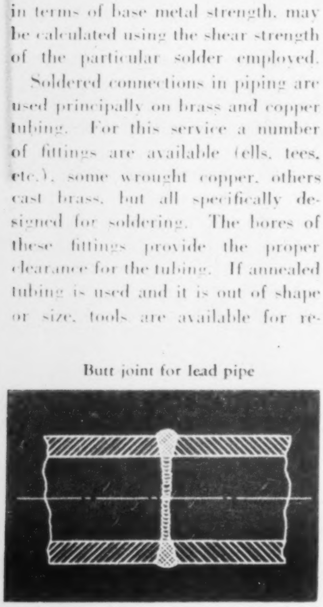
Soft Soldering Joints For Piping Work

Soft solder is generally an alloy of lead and tin in various proportions, depending upon the type of soldering to be performed. Other metals (e.g., silver, cadmium, etc.) may be added for specific properties. Generally speaking, the standard 50-50 solder (50 percent Pb, 50 percent Sn) is used in making soldered joints, while the higher lead alloys are used for wiped joints.

Solder is characterized by intrinsically low strength as compared with welding and brazing filler metals. As a result, soldered butt joints are rarely used and instead the lap or shear type joint is employed. As in the case of brazing, the thinner the cross section of solder (within practical limits) the stronger the joint. Best current practice requires that joint clearances be of the order of 0.003 to 0.006 inch. The strength of joints, in terms of base metal strength, may be calculated using the shear strength of the particular solder employed.

Soldered connections in piping are used principally on brass and copper tubing. For this service a number of fittings are available (ells, tees, etc.), some wrought copper, others cast brass, but all specifically designed for soldering. The bores of these fittings provide the proper clearance for the tubing. If annealed tubing is used and it is out of shape or size, tools are available for reshaping and resizing it as required.

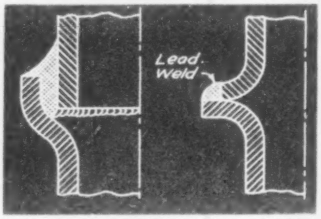
Butt joint for lead pipe



Another application of soldering to piping is for sealing threaded joints. In this case the solder is not expected to provide any strength but merely seals the threads to ensure against leakage. The threaded joint is made up in the usual manner and solder is applied at the juncture of the pipe and fitting in the form of a fillet. Chapter 23 of the AWS Welding Handbook contains further information on soft soldering.

Types of Lead Welded Joints

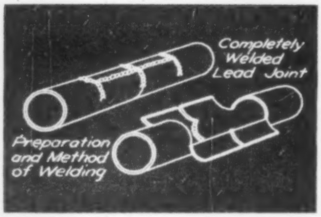
The design of joints for welding (sometimes erroneously called lead burning) lead piping is essentially the same as for other forms of welding. For thicknesses less than 3/16 in., the square-groove butt joint is employed. Thicknesses greater than 3/16 in. require beveling to an angle of 10 to 15 deg to give a groove angle of 20 to 30 deg. The pipe ends are first cut square and then beveled. A typical single vee groove butt joint for lead pipe is shown in an accompanying sketch.



Left—Cup joint for lead pipe. *Right*—Flange joint for lead pipe

Other types of joints are sometimes employed under special conditions. One of these is the cup joint, illustrated here, which is similar to a bell and spigot joint as used in cast iron. Still another special type joint is the welded flange joint, which is shown in one of the sketches. In this joint, a fillet weld is employed. Since lead is a soft metal, these joints may be prepared readily with simple hand tools.

Occasionally, situations will be encountered where the under side of the pipe joint will be inaccessible for welding. In metals other than lead such conditions should be avoided by careful field planning. In welding lead pipe, however, the solution is relatively simple by use of a split joint as shown in one of the accompanying figures. Such manipulation is possible with lead because of its extreme ductility.


Completely Welded Lead Joint
Preparation and Method of Welding

Split joint for lead pipe

Cleaning the joint before welding lead is very important. The edges and about 1½ in. on each side should be scraped with a scraper and welding should proceed within a short time after the cleaning. Chapter 36 of the Welding Handbook contains further information on the welding of lead.

Joints Between Dissimilar Metals

The joining of dissimilar metals by any of the welding processes is dependent upon the relative melting points of the metals to be joined. Thus, if the melting points are close (some authorities state within 50 F), it is generally possible to use either arc or gas welding, using a filler metal matching one of the base metals. If, however, there is a wide difference in melting points, then it becomes necessary to resort to brazing, braze welding or soldering. There is the further qualification that each of the metals involved in the joint must individually be capable of being welded, brazed or soldered.

The design of joints for welding dissimilar metals is exactly the same as that for welding similar metals. Groove and fillet welds of the standard proportions are employed. The differences in coefficients of expansion, thermal conductivity, etc., influence the welding techniques and procedure, not the joint design. Actually, there are very few dissimilar metals which may be welded. Stainless steels are sometimes welded to mild or low alloy steels, generally using stainless steel filler metal. Similarly, nickel and some nickel alloys may be welded to mild and stainless steels, as discussed in Chapter 35 of the Welding Handbook.

Brazing with silver-copper-cadmium-zinc alloys offers the best approach to joining dissimilar metals where the presence of this alloy is acceptable from the point of view of service requirements. It should be pointed out that copper-phosphorus and copper-silver-phosphorus brazing filler metals are suitable only for copper and copper base alloys, hence they should be used with care on dissimilar metals; they cannot be used on ferrous metals or nickel or its alloys. The standard joints employed in brazing similar metals apply equally well to dissimilar metals.

Soft soldering provides a means of connecting metals of widely differing melting points, particularly where one of the metals melts below the temperatures necessary for brazing. Soldering is also helpful in those situations where it is necessary to avoid the high temperatures of welding and brazing. Joint designs for soldering dissimilar metals follow the principles and standards established for soft soldering similar metals.

INGENUITY SIMPLIFIES UNIT A.C. INSTALLATION

Even when packaged air conditioners designed primarily for location in the space served, and thus not needing duct work, are used duct distribution of the air—or some of it—is necessary in many instances.

According to Al Weber, design engineer, Typhoon Air Conditioning Co., Inc., variation in the shape and size of the unit's plenum chamber can often obviate the need for or simplify the duct work required.

An example of an unusual plenum chamber is found in the Unity Club in Brooklyn, where a 10 ton unit is installed in the hall adjacent to the main dining room. An attractive, tapered three-way discharge grille projects through the wall, and distributes the cool air evenly to all parts of the dining room. Since this solution was not possible in cooling the rear dining room and lobby, however, short ducts, which pass inconspicuously along the ceiling of the hall, lead to grilles for these spaces. Ditmas Air Conditioning Co. installed the unit.

The problem at the French American Club, Lawrence, Mass., lay in the fact that an upstairs dance floor, with a capacity of over 400, was often partly or wholly empty, while the ground floor, with its bar, pool tables and card tables, could be expected to hold anywhere from 25 to 300 people, depending upon the occasion.

Packaged units were chosen to do the job, and so arranged that any variation of heat load could be easily and quickly accommodated. On the ground floor, two 10 ton units were installed, and one more was located on the second floor. A special plenum extension was built on top of the two downstairs units, leading up to the second floor. These plenum extensions lead to covered ducts on the second floor, which terminate in separate plenum chambers. A simple damper above the plenum of the unit downstairs prevents cool air from rising to the floor above except when needed; when more cooling is required in the upstairs dance hall, the damper is turned by a lever so that it blocks off the discharge grille of the downstairs unit, sending all the cool air upstairs.

Thus, "a flick of the wrist" will send 10 tons of refrigeration out into either floor from either unit. But 20 tons will not suffice for the dance floor when upwards of 400 people are moving around or dancing. So the other 10 ton unit was placed on the second floor. When there is a large crowd downstairs, only the one unit is needed to cool the dance floor, since almost never are both floors of the club crowded at once. But how about the lower floor, when there is a big dance or wedding upstairs, and all available air conditioning is needed there? The answer is return air from the upper floor passes back to the ground floor, and provides cooling for patrons of the bar and other facilities. Lebowitz Brothers made the installation.

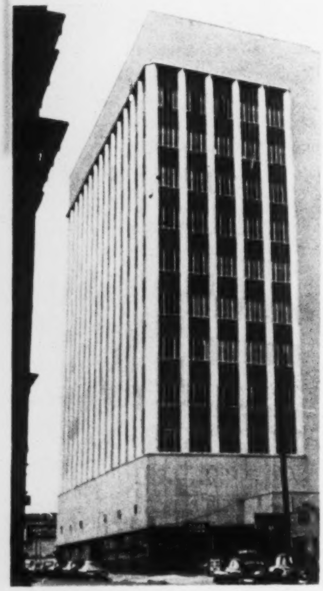
Left—An extended plenum chamber from the 10 ton air conditioning unit behind the wall at the right projects through the wall to serve the main dining room at Brooklyn's Unity Club. Short ducts from the same unit convey the air to the rear dining room and lobby. *Right*—Plenum extensions from units on the first floor of the French American Club, Lawrence, Mass., allow them to serve the dance floor upstairs when demanded by the occupancy

Air Conditioning Ducts, Piping Run On Outside of Building

ALUMINUM FINS on the exterior of the Employers Insurance Building, Dallas, are an architectural feature of this recently completed structure. However, they also fulfill a utilitarian feature, for within them—but on the outside of the building itself—run the trunk ducts and water and drain pipes for the air conditioning system.

This air conditioning installation is also somewhat unusual in that steam absorption refrigerating units furnish the chilled water requirements. The refrigeration and the reasons for selecting this type of equipment were discussed in some detail in an article in the May HPAC. The description of the complete installation is our subject this month.

North face of the Employers Insurance Building, showing the architectural fins within which run the trunk ducts, water and drain pipes for the air conditioning system



The refrigeration supplied by the steam absorption units is used in a conduit system and in conventional air conditioning systems for the 12th and 13th floors, central zones of the office floors and the first floor. Forty-two degree water is provided for all cooling purposes. The chilled water is pumped to the primary air units for the conduit system and to the individual cooling systems. Three zone pumps, in series with the primary cooling coils, pump the water from the primary coils to the individual window units throughout the building. This water, of course, is at a higher temperature than the water leaving the absorption machines. Its purpose is solely for sensible cooling, which does not require such low temperatures.

Optimum Conditions for Contractor

In basic design, the conduit system in this building is, in general, very similar to other installations of the same type. However, the location of the trunk ducts and water and drain pipes for the window units is a distinct departure from usual practice. While the building was under construction, these pipes, to all intents and purposes, were on the outside of the building. At no point was it necessary for floor slabs or concrete beams to be pierced by any of these pipes. There was no problem of locating sleeves, an exacting task in concrete forms or metal decks. After the slabs were poured, when the columns were in place and the floors ready to receive the final finish, the mechanical contractor was able to go in and—under optimum working conditions—locate his risers.

These risers were more or less draped on the outside of the building, heavily insulated and then encased in aluminum fins. Now that the building is complete and occupied, there is no indication that these fins are an integral part of the air conditioning for the building. Placing the air conditioning risers on the outside of the building made it possible to have a perfectly flat interior wall surface. The only breaks in the walls are the window openings. Besides gaining a more usable wall, there is a gain in usable floor space in the building.

The building has three main exposures—north, east and south—and the primary air system was divided into three zones to accommodate the fluctuating requirements of these exposures. Each zone has its own pump, fan and reheat coil. Common filters, preheating coils and cooling coils are provided for all zones. All of the equipment is located on the 12th floor, so the air and water distribution is downward.

Finding Space for Equipment

In the original planning for the building, the use to which the first floor was to be put was left to be determined later. It was thought at that time that the first floor would be divided into several stores, each of which would have its own air conditioning equipment situated in the space to be conditioned and supplied with chilled water from the main chilled water pumps. However, as seems to be the case 95 percent of the time, guessing future requirements turned out to be a futile pastime. When the building was 75 percent complete, it was decided that the first floor would be owner-occupied and that the space on the floor was too valuable to give up to air handling units for the air conditioning.

H. G. GREGERSON, chief mechanical engineer for George L. Dahl, architects & engineers, describes the air conditioning installation for the Employers Insurance Building, Dallas, where the trunk ducts, water and drain pipes for the system are on the outside of the structure but concealed within the architectural fins. Chilled water is furnished by steam absorption refrigeration, gas fired boilers (with standby oil) installed on an upper floor being operated the year 'round for heating, cooling

We then had to find space that could be used for no other purpose, in an already crowded basement, for the units to air condition the entire first floor. Inasmuch as the first floor has three zones—east, south and central—we found it necessary to use a blow-through type of unit. There was insufficient space for three individual fans. One cooling coil and one heating coil with three sets of controls and dampers were installed to provide the necessary zoning. The filters for the unit were placed between the fan and the coils in order to provide an even distribution of air over the coils.

Handling the "Active Storage" Spaces

During the planning stages for the building, it was determined that the space not used for machine room and other mechanical features of the building on the 12th and 13th floors would be used for storage. Inasmuch as storage space does not rate cooling in most buildings, it was felt that ventilation in the amount of about eight to 10 air changes of exhaust air from the air conditioned spaces in the building would be more than satisfactory for these areas. However, when the building was better than 50 percent complete, it was determined that these spaces would be used for what you might call active storage, with several people working in them all day long. Inasmuch as both of these spaces were subject to considerable heat inflow through the walls and roofs and a common wall to the machine room (the machine room on the 12th floor extends upward two full floors), it was felt that air cooling was mandatory. The original plans called for these storage spaces to be ventilated with exhaust air from the building, which would be pumped into these spaces and relieved into the machine room. This was intended to give a measure of cooling but was not supposed to maintain comfortable working conditions.

When we found that it would be necessary to air cool these storage spaces, we felt that we should provide outdoor air as is customary with air cooling. However, we also found that we were trapped by stairwells, elevator shafts and building walls on property lines. We found no way to obtain this outdoor air, except to redesign a building that was structurally almost 100 percent complete. Not wishing to go to the expense of disturbing the structure of the building, we decided to go along with our original plan and use air that was being exhausted from the air conditioned portions of the building. By providing cooling, keeping the number of air changes fairly high and not recirculating any of the air, these spaces have a feeling of being airy with no signs of stuffiness.

The amount of air supplied to the 12th and 13th floor storage spaces is quite large. All of it is relieved to the boiler room, which is adjacent to these spaces. This air, entering the boiler room at approximately 80 deg, has proved to be an excellent means of keeping the boiler room temperature down. As can be readily imagined, the boiler room, having a heavy roof load and two boilers being fired at about 80 percent of their full capacity, has a tendency to be very warm. With this 80 deg air being supplied to it, the boiler room seldom goes above outdoor temperature.

Allowing for Space Shifts

One of the major problems of an office building is that of shifting space requirements during its life; they change from year to year. These changes, of course, always mean moving partitions. When partitions are moved, it entails the moving of lights and air distributing outlets.

Almost all of the partitions in the building are of the movable type. The ceiling construction is acoustical tile, which is interchangeable with the lights so that the lights can be moved without too much difficulty. The acoustical tile selected is a metal perforated tile with a 1 in. pad used in conjunction with it.

To remove the obstacle of moving unwieldy duct work and outlets, the ceiling is used for air distribution, the space between the ceiling and the

In the interior zones, the space between the metal tile ceiling and the floor above is used as a plenum. The acoustical pads are omitted where it is desired that air be supplied. The scheme permits flexibility in relocating partitions

floor above being employed as a plenum. Duct work is extended into these plenums, with outlets on top of the duct work. The purpose of the duct work is to distribute the air evenly in the plenum.

To gain a medium of control over the air distribution system, the acoustical pads are left out in the areas where it is desired that air be supplied. By moving these acoustical pads from one place to another, it is possible to change the amount of air supplied to the various areas. Because of the very low air velocities used in this type of distribution, it was necessary that the air changes in the conditioned spaces be set at between 10 and 12. This builds up the air movement to the place where the spaces do not feel stagnant.

"What Goes In Must Come Out"

"What goes in must come out", so provision was made for exhausting all of the air supplied to the building. This makes it simple during the off-seasons to use 100 percent outdoor air and to get rid of it without difficulty. The toilet exhaust fans and a few minor exhaust fans about the building account for between 15 and 20 percent of the air supplied to the building. During the times that the various systems are operating under maximum or near maximum loads, it is not necessary to operate the large exhaust fan used to exhaust the air from the building. The fan is equipped with vortex dampers controlled by a static pressure regulator such that it adjusts itself to changing requirements.

In an endeavor to make the most use of all air that is cooled, the toilet exhaust fan discharges into the well provided for the cooling tower.

Standby Oil for Gas Fired Boilers

The boilers (which are used for both heating and cooling) are low pressure steam boilers of conventional design, operated at 13 lb per sq in. Because of their location near the top of the building, each boiler is equipped with an induced draft fan. The boiler burners are low pressure gas of the upshot type, rated at 125 percent of the boiler capacity.

To insure uninterrupted heating during the winter, the boilers are equipped with standby oil burners of the high pressure gun type. There is a 4500 gal oil storage tank in the basement, and oil is pumped to day tanks on the 12th floor where it is available for use by the oil burner pumps.

Except for the toilets and stairwells, the entire building is heated by air. The bulk of the heating, of course, is taken care of by the conduit system units located at each window. The three zone pumps used for circulating chilled water to the window units in summer are used in the wintertime for circulating heated water. This hot water makes it possible to heat the primary air to a warmer temperature if required.

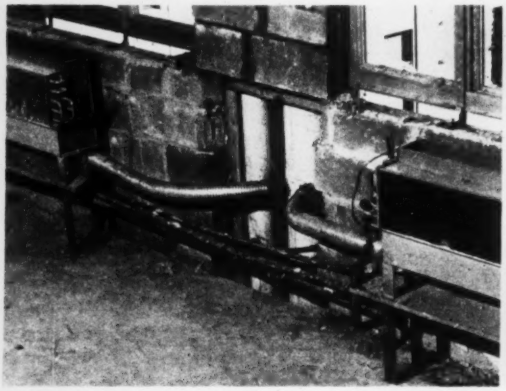
Flexibility for In-Between Seasons

In the in-between seasons, in order to provide a high degree of flexibility in the exterior zones, it is possible to supply cooled primary air, with hot water being supplied to the window unit coils to give the occupants the possibility of selecting the temperatures they desire. This process can also be reversed, with warm air being supplied to the exterior zones and chilled water being supplied to the coils in the window units.

The basement, which is used for automobile storage, is supplied with a large quantity of ventilating air at one side and exhaust at the far side. The exhaust is arranged in such a way that the air can be taken either from the floor line or from the ceiling to insure removal of gases.

The Employers Insurance Building, owned by the Texas Employers Insurance Association and Employers Casualty Co., was built from plans and specifications drawn by George L. Dahl, Architects & Engineers. James Stewart & Co. handled the general contract work and the C. Wallace Plumbing Co. installed the mechanical equipment.

Left—Runouts from the vertical risers to the conduit system units are shown in this construction view. *Right*—The boilers are used for both heating and cooling, are located near the top of the building. Fired by gas, they have standby oil burners. The oil is stored in a 4500 gal tank in the basement, and is pumped to day tanks on the 12th floor



Piping Saves Lives in the Submarine Navy

HOWARD S. DEWEY, who has had several years of experience as an engineering officer in submarine service, describes the piping facilities at the Navy's escape training tank, where student submariners are taught the use of the Momsen lung

AT THE ESCAPE training tank at the U. S. Naval Submarine Base, New London, Conn., a voice shouts "Flood the tank." A huge gate valve wheel swings slowly around and the first of 250,000 gal of water is pumped into the 134 ft silo-shaped steel structure. The tank, with its maze of piping, filters and steam heaters, is back in commission after its annual overhaul and the training of Uncle Sam's submariners proceeds.

This aquatic classroom is the answer to two submarine disasters which shocked the American people back in the late 20's. In this period between wars the submarine navy suffered the loss of the USS S-4 and the USS S-51 with their crews. Equally important was the lowering of submarine personnel morale and the loss of the American people's faith in the Navy's ability to care for its own. "Why," it was asked, "had no provision been made for these men trapped in their steel coffins to escape a death of agonizing suffocation in the carbon dioxide filled compartments."

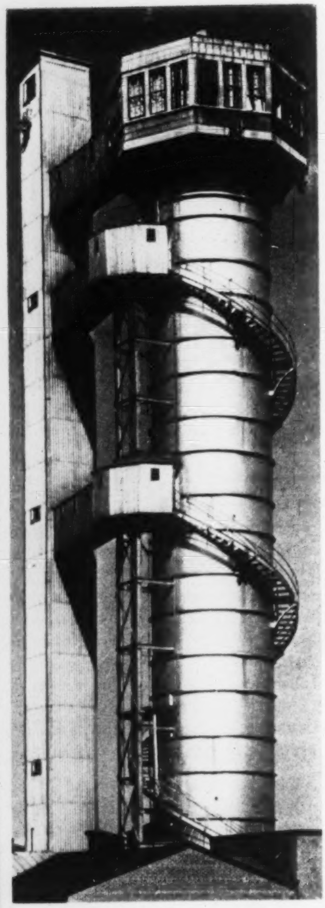
Admiral (then Lieutenant) "Swede" Momsen accepted the challenge of providing the submarine force with the necessary escape device. From his work in the following years was developed a rescue breathing device which became known as the Momsen lung. It is actually a third lung for the wearer when charged with oxygen, and has proved a simple and effective means of escaping from sunken submarines.

With a group of volunteers, Lieutenant Momsen conducted tests of his lung in the warm waters surrounding the Florida coast. More problems were to result, though. Treacherous currents and tides accompanied by marauding sharks and curious barracuda slowed and complicated the task. These, plus the vagaries of a fickle Mother Nature, made outdoor tests and training impractical.

Naval engineers suggested building a tank in which to continue training and development tests. Following such tests, the tank could then be used to train submarine personnel in the use of the lung. The training tank was completed 20 years ago last August at a cost of $90,000. Lieutenant Momsen became the first officer in charge.

For convenience, the tank was constructed on the banks of the Thames river which flows past the submarine base and empties into Long Island sound. For realism and because it was easily accessible, the river's salty water was used. This introduced a new problem, however, as when heated the water left mineral deposits which coated the tank and piping. At its normal temperature

An instructor opens a valve to backwash the filters, watching a glass eyeport in the line to stop the process when sand starts to flow (Official photograph U. S. Navy)



The Navy's submarine escape training tank is a 134 ft high structure holding some 250,000 gal of water. A maze of piping services is required for its operation (Official photograph U. S. Navy)

the water couldn't be used, as even the rugged submarine sailors found it difficult to build up any enthusiasm for a plunge in the tank during the winter months.

Fresh Water Is Used

It was then decided to employ a system similar to that used in swimming pools. Fresh water is obtained from two sources, one from the nearby borough of Groton's water mains which supply the submarine base and an emergency supply which can be obtained from a small lake located high enough above the base to create sufficient head pressure for the tank's uses. In both cases the water is routed by underground piping to the overflow tank in the maintenance building at the base of the tank.

The 20,000 gal overflow tank is drum-shaped and equipped with float gages that tell at a glance the amount of water. An open manhole on the top of the tank provides venting.

The piping which is used to route the water from the overflow tank through the various systems is high pressure steel, ranging from 2 in. to 6 in. in diameter. From the overflow tank, the water feeds a 1760 rpm centrifugal pump with a capacity of 600 gpm. The pump discharges to three filters rigged in parallel, where the water is cleaned while being forced through successive layers of heavy rock, gravel, coarse sand and fine sand. A thin layer of gelatinous alum which is fed into the water before it enters the filters by use of venturi tubes supplies the final cleansing action to the water. It takes 300 lb of sand to form a 1 in layer in each filter.

The filters are cleaned once a week by backwashing. Water from the filled training tank is allowed to flow back through the filters at a natural head pressure of approximately 50 lb. Dirt that has accumulated to the clinging particles of sand is washed loose and discharged through lines that bypass the pump and the overflow tank to the river. This sweeps the alum with it and 10 lb is added to the alum pots following each backwashing of the filters.

From the filters, clean water is discharged to the bottom of the training tank. Although this means pumping it against a head pressure of approximately 50 lb, it is necessary in order to obtain recirculation of the training tank's contents through the filters and overflow tank. It takes 12 to 14 hr to complete a full recirculation of the tank's entire contents.

Excess water in the tank drops down through a 6 in. overflow line into the overflow tank. The overflow tank can be bypassed and the water directed to the suction side of the pump. In the overflow tank are the steam heaters. A simple arrangement of perforated pipes which jet live steam directly into the water heat and maintain it at a desired temperature of 92 F.

Snifter Valve Cushions Shock

So that the pump and overflow tank will not be subjected to the constant head pressure of water from the training tank, a flapper valve is located on the discharge side of the pump. When the pump is secured, this valve shuts with a noise like a blast from a cannon. To reduce this, a snifter valve (a pipe shaped cylinder) was introduced in the line and a pocket of air cushions the shock the flapper valve had previously been subjected to. This has eliminated considerable maintenance work — something the instructors attached to the training tank have been thankful for.

Only the steam line is lagged to reduce heat loss and protect operating personnel. Water lines are painted for preservation and identification. Stop valves and bypass lines provide emergency protection in the event of a casualty to the piping.

With a constant flow of submariners entering the tank for instruction or refresher courses in the use of the Momsen lung, the problem of keeping the water clean reared its unsanitary head. This is met by use of chlorine which is added to the overflow tank. Occasionally soda ash is added to reduce acidity in the water. It serves a dual purpose as it reduces opaqueness which assists the tank instructors in keeping close watch on students making their first ascent from the bottom of the tank.

When the water in the tank is completely renewed it must be recirculated through the filters four times in order to obtain the clearness desired. It is seldom necessary to replenish water from normal sources once the training tank is filled, as approximately 100 gal a day is added into the system from condensation that forms on metal surfaces.

A chemical analysis is taken of the water daily and recorded for the medical officers inspection. Occasionally copper sulphate crystals are added to the water to kill sea growth which forms a mossy coat on the sides of the training tank. In warm water such as is used in the tank, it is necessary to do this periodically.

Emergency Supply for Fire Mains

Aside from being a training device the tank with its water under natural head pressure is also an emergency supply for the submarine base's fire mains. Normally it is not desirable to empty the tank as the water provides a stabilizing effect on the tank structure. Even during the hurricane season when strong winds are anticipated the water is not removed. In the event of an air attack on the base in which the tank could be damaged, causing a large volume of water to flood the surrounding shops, the tank could be quickly drained into the river.

Rightfully described by the tank personnel as being one huge pipe and a lot of little pipes, the training tank is served by still another type of piping. This is the copper air piping used to supply the recompression chambers with high pressure air. The recompression tanks are similar to those used by deep sea divers suffering from the bends.

Before a student is submitted to the tank's water pressure, which reaches 50 lb at the bottom, he is tested for his ability to equalize pressure on his ear drums. This is done by use of the recompression chamber. Within the barrel-shaped recompression tank the students sit on wooden benches while air pressure is built up to 55 lb.

This is simply a safety precaution to forestall inadvertently jeopardizing a student's life in the water filled training tank where such ability is necessary. Air is obtained from two motor driven high pressure air compressors. The compressed air is routed through copper tubing to a nest of four air flasks having approximately 50 cu ft capacity. These flasks maintain a volume of air under pressure for the recompression chambers, which are in almost constant use.

In World War II, the tank was a valuable contributor to the training of student submariners. It is expected that it will be no less valuable in any possible war of the future.

WINS AWARD FOR VALVE SUGGESTION

Frank Marocco, of the Public Service Co. of Northern Illinois, recently received an award under the company's employee suggestion system for an idea that has simplified and cut the cost of valve maintenance. For several years, power relief valves on main steam headers at one of the company's generating stations had given considerable trouble due to leakage under the seat.

Frank Marocco recently received an award for an employee suggestion that reduced valve maintenance at the Public Service Co. of Northern Illinois. He holds a valve similar to the type redesigned here, as the redesigned valves themselves were all in service when this photo was taken

In order to make repairs, the valves had to be removed from their location. Repairs usually involved building up the valve body, machining the threads and installing a new seat. After all this work had been done and the valve re-installed, it frequently operated once and started leaking under the seat again.

Mr. Marocco suggested that the screwed-in seat be eliminated. The body of the valve was machined and built up by arc welding with stainless rod. A new seat was then machined in the area built up with the rod.

There are four of these relief valves, three of which have been repaired in the suggested manner; the fourth valve will be thus repaired as soon as possible.

Since these repairs were made, all three valves have operated several times and they are still tight and in good condition. The annual savings in maintenance labor and material, steam loss due to leakage through the valve, and outage of equipment justified the award.

OVERFIRE JETS DO MORE THAN REDUCE SMOKE

Although the benefits of overfire jets in abating smoke and contributing to air pollution are being increasingly recognized and realized in field practice, there is comparatively little published data on the additional benefits that may accompany the use of jets, according to W. S. Major, until recently development engineer of Bituminous Coal Research, Inc.

"For instance," he says, "reliable test data have shown the following accompanying overfire jets on various types of commercial and industrial furnaces:

1.) Increasing boiler and furnace efficiencies by 1 to 3 percent.
2) Reduction of both the quantity and carbon content of the cinder carryover.
3) Shortening of the flame and reduction of the final temperatures when surfaces have the same degree of cleanliness.
4) Reduction of soot and slag deposits on boiler and economizer surfaces.
5) Ability to operate with slightly lower excess air without unburned combustible gases.

"Perhaps the most significant benefit of overfire jets other than abatement of smoke is the reduced amount of soot carried in the gases leaving the furnace. This in turn results in a higher average heat transfer rate because there is little soot to insulate the surfaces of the boiler and retard absorption of heat from the gases", according to Mr. Major.

The new boiler house location is at the far end of the range so that it will not interfere with future expansion. The space previously occupied by the old boiler house in the center of the development is now used for a modern packaging and shipping department

New Boiler House Cuts Steam Cost $14,000 Yearly

THOMAS YOUNG, the world's largest grower of orchids, last year shipped 1,100,000 orchids to distributors in 43 states. The Thomas Young "range" in Bound Brook, N.J., consists of 43 greenhouses covering 5½ acres of ground and with a glass area of 330,000 sq ft. Under these roofs are housed 280,000 mature orchid plants and 100,000 seedlings. Fifteen hundred different varieties of orchids are grown. Normally it takes seven years for a plant from seed to flowering. The seedlings as well as the mature plants require temperatures from 55 to 70 F.

The heat requirements of greenhouses differ from those of other structures. While the heat losses through the glass areas are high, use is made of solar radiation, so that down to 16 to 18 F outdoor temperature, no heat is needed in addition to that from the sun. However, at sunset or when the sun is concealed by clouds, a large amount of heat is required immediately.

A considerable heat loss is also caused by the ventilation of the greenhouses, which at times amounts to 40 air changes per hour. When the outdoor temperature drops below 20 F, the condensation freezes and seals the cracks between the glass panes and the infiltration becomes practically zero.

Three New Boilers Replace 13 Old

Up to last year, the Thomas Young greenhouses were heated by five high pressure boilers installed in one boiler house and eight low pressure boilers installed in basements.

The main boiler plant was located in the center of the range, taking up valuable space. The new boiler house location, chosen so that it would not interfere with future expansion, was placed at the far end of the range. After completion of the new boiler house, the space of the old boiler house was utilized for a shipping department.

The steam generated in the new boilers is carried through an 8 in. line over a distance of 900 ft to a steam header at the old distribution center. The condensate is collected in the existing condensate pit and pumped to the new boiler house.

The steam is generated at 125 lb pressure and travels through the mains to pressure reducing stations located at strategic points over the greenhouse range where it is reduced to 15 lb before entering the 34 miles of heating coils installed in the greenhouses. The condensate flows by gravity to two dual pump condensate units from where it is pumped to a large collecting tank installed on an elevated platform in the boiler house. Two transfer pumps deliver the condensate to the deaerating feedwater heater, which heats it to 227 F by means of exhaust steam. Two boiler feed pumps, one steam turbine driven and one motor driven, feed the water into the boilers, the

PHILIP H. OPPENHEIMER, consulting engineer, describes the installation of a modern boiler house designed for a large greenhouse range. By careful selection of the equipment and by providing automatic controls and instruments, a reliable supply of heat to the hot houses at all times has been assured. By replacing manual labor to a large extent by conveyors, considerable savings in fuel and labor cost have been accomplished, and it is conservatively estimated that modernization is saving $14,000 annually, or 28 percent

water level of which is maintained by automatic regulators. Each pump is designed for the total boiler house load.

Thorough consideration was given to the selection of fuel, boilers and stokers. After bituminous coal was chosen, the specifications for the boilers and stokers were set up as follows:

The fuel must be burned efficiently from a minimum load of 3000 to a maximum load of 20,000 lb per hr per boiler.

The maximum heat release must not exceed 30,000 Btu per cu ft of combustion chamber; the maximum burning rate must not exceed 30 lb per hr per sq ft of grate area.

The stokers must be able to burn a wide range of low priced coal without smoke, since smoke and fly ash are injurious to the plants.

The boilers must be able to produce 15,000 lb per hr of steam within 15 minutes from a banked fire. The fires must be banked without difficulties during sunshine hours.

Three 300 hp boilers were installed, fired by underfeed single retort stokers. The furnaces are water walled, the boilers are completely insulated and connected by a common breeching to a brick chimney 135 ft high. All auxiliaries, such as feedwater pumps, transfer pumps and forced draft blowers, are placed in front of the water tube boilers for ease of operation.

Two boilers can generate 40,000 lb of steam continuously, which is ample for the steam requirements of the range at 5 F below zero. The third boiler is a standby.

Coal and Ash Handling Facilitated

The coal is unloaded from dump trucks into a coal hopper from where it is carried by an elevator to the top of a 300 ton coal silo. From the live shelf of the silo, the coal slides through a chute into a screw conveyor which passes across the stoker hopper of each boiler. Between the chute and the screw conveyor an automatic coal scale is installed.

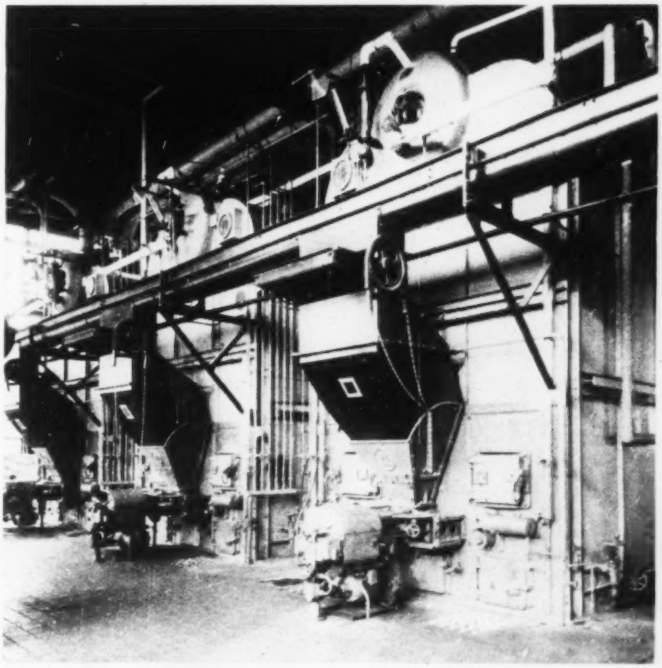
The ashes are pulled manually from the ashpits to intake grilles of the pneumatic ash conveyor system placed immediately in front of each ash door, from where they are conveyed by vacuum to a 14 ton ash silo outside the boiler house. A steam ejector produces the vacuum. The ash conveyor is so designed that the ash remains dry during its travel. When the ash silo is filled, which takes from two to three weeks, it is emptied into trucks. In unloading the silo, the ash is wetted to prevent dust.

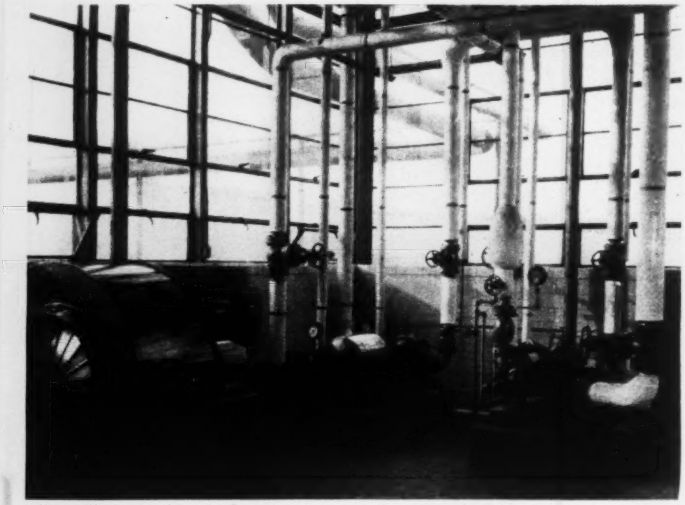
Electric power is brought to the new boiler house at 4150 volts and is transformed to 240 volts ahead of the main switchboard for the plant. A gasoline engine driven emergency generator of sufficient output to supply all essential needs in case of power failure is installed in the boiler house. By means of a double throw switch, the electrical power can be supplied from the emergency generator in less than a minute.

Essential instruments are provided to tell the operator what is going on in the boilers, such as recording steam air flow meters, recording steam pressure gages, draft gages, and condensate and boiler feedwater temperature recorders. All instruments and controls are mounted on a control board in front of the boilers.

An automatic combustion control maintains a constant steam pressure

Three new 300 hp boilers in the new boiler house replace the five boilers in the old boiler house and the eight boilers in various basements. The new boilers burn bituminous coal which is fired by underfeed stokers





All auxiliaries, such as feedwater pumps, transfer pumps and forced draft blowers, are placed in front of the boilers for ease of operation. Floor and walls of the boiler house are tiled, making them easy to keep clean

and the proper air-fuel ratio for efficient combustion by means of a master sender which is actuated by changes in steam pressure. It sends out pneumatic impulses proportional to the pressure changes that increase or decrease the forced draft fan damper opening and the stoker speed of each boiler. The furnace draft is kept constant by uptake damper controllers which automatically balance the uptake draft.

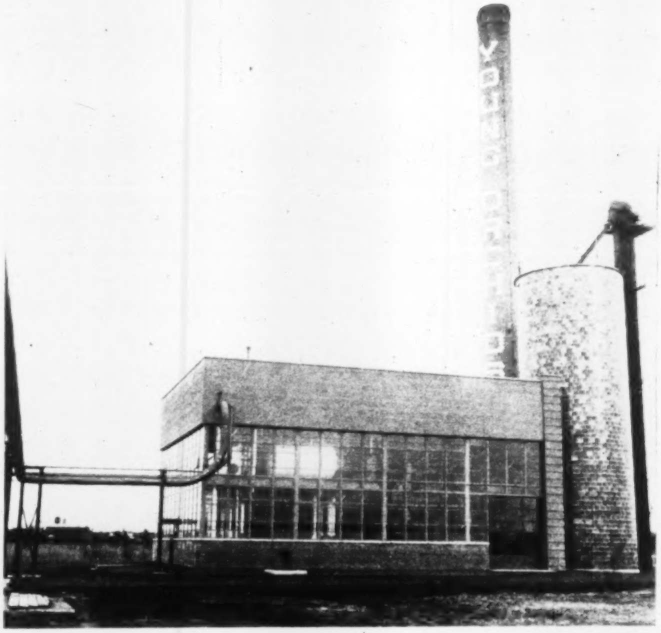
The boiler house itself is of modern structural steel design with glass 18 ft high on three sides, providing plenty of natural light. The floor and the walls of the boiler house are tiled, making it easy to keep it clean. Since the coal is unloaded outside the building, since all coal conveyors are enclosed and the ash dust is drawn by the high suction of the ash handling system into the intakes, the housekeeping is made easy, and thanks to the excellent maintenance of the chief engineer, A. P. Green, the boilerhouse is spic and span at all times.

During the past winter there was an exceptionally good opportunity to give the new boiler house a severe test when during several nights the temperature dropped to 8 F above zero, with strong northwest winds. Two of the boilers operating at 125 lb pressure were able to maintain the exact temperatures desired throughout the range, for which job previously 13 boilers were required. When quick heat is required, the boilers can produce 20,000 lb per hr of steam within 15 minutes.

Annual Saving of $14,000

While formerly a premium coal had to be fired, a much more economical coal can be burned now at higher efficiency. By mechanization of the coal and ash handling, the greatest part of the manual labor has been eliminated. The new boiler house is operated by one fireman.

It is still too early for an exact accounting of the savings which have been realized. The boiler efficiency is still improving as the operating personnel previously used to hand firing, are becoming more and more familiar with the controls, instruments and the mechanical equipment. However, based on last winter's performance, it is conservatively estimated that the annual expense for fuel and boiler house labor, coal and ash handling has been reduced by $11,000 or 28 percent.



The new boiler house is of modern design, has large glass areas to provide ample natural light. Because of the coal and ash handling facilities, and the excellent maintenance of Chief Engineer A. P. Green, it is spic and span at all times

Studies on
HEALTH AND AIR CONDITIONING

Physical Environment Control Essential in Nutrition Studies

If the physical environment of an animal bears no relation to its nutritional processes, obviously nutritional investigations could be pursued with no reference to the environment. But this is not true. The factors of climate, temperature, humidity, air motion, air composition and pressure do modify the nutritional processes by modifying appetite, the body temperature, the heat economy, the water balance, endocrine activity and probably in many other ways. The chemical reactions that occur in the animal body involved in food utilization are subject to the Van't Hoff-Arrhenius equation relating temperature to reaction velocity, the same as chemical reactions occurring in a beaker. Thus, for each elevation in body temperature of 1 C. induced by a hot environment, the velocity of metabolic reactions would be expected to increase (within reasonable limits) by about 30 percent. Therefore, measurements of nutrient requirements and of the utilization of food nutrients in the animal body, to be comparable, must be made under comparable—preferably identical—environmental conditions. Furthermore, each such measurement may be dependent, more or less, upon the environmental conditions prevailing.

Before the days of air conditioning, the effect of the physical environment on nutritional measurements was offset as far as possible by selecting geographical locations and seasons of the year such that weather conditions could be presumed to be comparable. If it was desired to compare the physiological effect of food in normal men and in obese men, the wise plan would be to make measurements on the two types of subjects simultaneously and in the same room; or, if different laboratories were cooperating, to run the tests at least in the same season of the year. But there could be no assurance in the latter case that weather factors had indeed been equalized and that the observed differences in the calorigenic effect of food were indeed due only to constitutional differences in the subjects observed.

One of the most confusing aspects of climate (or weather) in nutrition investigations on animals is its effect upon appetite and upon the consumption of food. In livestock feeding, rations are in part evaluated and compared on the basis of the feed cost of the gains in body weight induced or the feed cost of the milk or eggs produced. But for the same ration the feed cost of gains will be higher on a hot, humid day than on a cool, dry day, because the appetite of the animal will be much poorer on a hot, humid day than on a cool, dry day, regardless of the nutritional quality of the ration. Comparison of cattle rations made in different localities may be vitiated for this reason.

Why Does the Eskimo Eat Fat?

In attempts to evaluate effects of weather factors on nutritional needs in the absence of means of controlling the physical environment of animals and man, recourse has been had to the observational or statistical method rather than the experimental method. For example, there is much information available from dietary studies of the food habits of men living in the widely differing climates prevailing on the earth's surface. The dietary habits have been observed to differ about as widely as the climates themselves.

But the interpretation of food habits in terms of climate offers discouraging difficulties. For example, the Eskimo consumes a high fat and high protein diet, while the inhabitant of Central America consumes a low fat and a low protein diet generally. Do these differences in food habits prove that in a cold climate the body's requirement for fat and protein foods are increased, or are the observed differences in diet due solely to differences in food availability? The fact that some tropical communities do consume large amounts of vegetable oils favors the latter explanation, but other evidence may be cited to the contrary. Many tropical communities like highly spiced foods, as compared to communities in temperate or sub-polar regions. Does this mean that spices perform some nutritional function in a tropical environment, or does it mean merely that spices are freely used in the tropics to disguise the food spoilage so readily brought about by the high temperatures of the environment? These illustrations point to the great weakness of the statistical survey method of nutritional research—namely, that the establishment of correlations between two variable factors is not equivalent to the establishment of a causal relationship.

With the advent of engineering equipment for the conditioning of laboratory air, many of the difficulties in the interpretation of animal feeding experiments were removed. In animal laboratories conditioned for comfort, it is possible to pursue experiments in a standardized environment, with the result that different experiments in the same laboratory performed at different times are more comparable in their results, as are experiments performed in different laboratories. At the present time, every well-equipped nutrition laboratory has air conditioned rooms for the feeding of experimental animals. Not the least advantage of this control of physical environment is that experimentation can be continued through the hot seasons of the year. Many nutritional problems relating to senescence and longevity require continuous study through several years. Without environmental control, such problems could not be studied effectively in any climate.

Climatic Aggression May Modify Needs

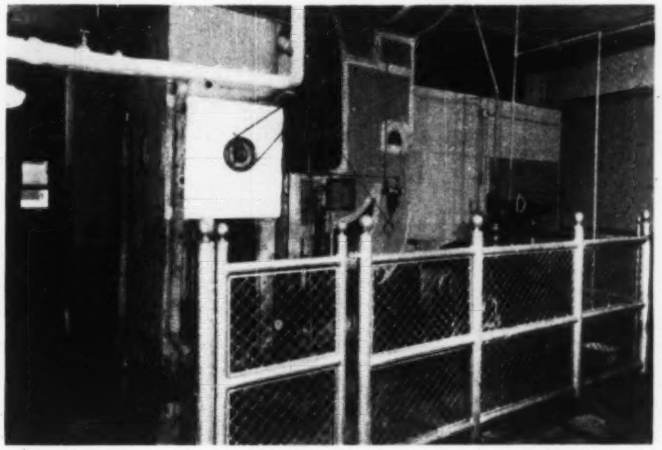
Experimental rooms and chambers maintained at constant temperature, and sometimes at constant humidity, and conditioned for comfort, thus constitute a distinct and important advance in engineering equipment for nutritional research. But while such rooms and chambers are still immensely useful in eliminating the effects on experimental research of variable environmental conditions, they have their limitations—they do not permit an adequate study of the effects of variable weather conditions on nutritional needs and processes. It has been objected to experiments so controlled that we are studying the animal—or human subjects, as the case may be—in a protected environment, whereas in real life the animal is subjected to severe climatic stress at different seasons and in different geographic areas, as is also man except as he protects himself by appropriate clothing and housing. Climatic "aggression," as it has been called, may well modify nutritional needs and nutritional processes. The factors in this climatic aggression are extremely high or low temperatures and humidities and high altitudes, especially the high altitudes attainable in an airplane. Rapid air motion and intense solar radiation are other factors in climatic aggression not so easily controlled.

The effects of these stresses had been revealed in practical life, but their study, in the absence of precise engineering equipment, had been difficult because of the inability to impose climatic stress at will and in a controlled manner. For example, in a series of experiments on the thiamin requirement of man, workers at the Mayo Foundation, using ambulatory hospital patients as subjects, placed them first upon a diet very low in thiamin to deplete their stores of thiamin in the tissues, after which their response to graded doses of the vitamin was observed. In one experiment carried out in the summertime, the subjects had to consume the depletion diet for 147 days before the signs of deficiency appeared. In another experiment carried out in the winter months, the subjects showed deficiency symptoms in a much shorter time, 88 days.

From the comparison of these two experiments it was concluded that a cold environment intensifies the thiamin requirement, thus using up the body stores in a much shorter time. The acceptance of this most obvious interpretation of the data may be questioned on several grounds, and at most it gives no information on the quantitative increase in requirement associated with a definite lowering of environmental temperature, if such a lowering actually occurred. The environment was not under effective control and its variations could hardly be assessed in any simple and adequate manner.

The mammary gland of the dairy cow, occupying an exposed position on the body, would be expected to be especially susceptible to climatic aggression. Many observations of the effect of very cold weather and very hot weather on milk production and milk composition have been reported in the literature. In the absence of environmental control, however, the observations have been expressed for winter months and for summer

H. H. MITCHELL, of the Division of Animal Nutrition, College of Agriculture, University of Illinois, explains the need for control of the physical environment (temperature, humidity and other factors) in nutritional investigations, as environmental factors have a considerable effect on the nutritional processes of animals (including man). Without air conditioning facilities, many studies are impossible and others may be incorrectly interpreted. The importance of air conditioning to health becomes more apparent every day, and such studies as those mentioned here indicate the ever-increasing importance of air conditioning in modern life, industry, commerce and agriculture



An experimental chamber was installed in 1931 in the laboratories of the Division of Animal Nutrition at the University of Illinois to study the effects of temperature and humidity upon the nutrition of farm animals

months, but these terms are very poor descriptions of environmental conditions, since the weather in any one season varies greatly in the same locality—and much more so in different localities.

Stress—Not Comfort—Conditions

So again the engineer was called upon to provide precise equipment for imposing not comfort conditions but stress conditions. One of the first experimental rooms of this type for the study of the nutrition of farm animals was erected at the Animal Nutrition Laboratory at the University of Illinois at Urbana in 1931. With this equipment we have been studying the nutrition of cattle at temperatures ranging from 40 F to 85 F, and in our new building which will be erected within the next two years, we will be able to impose temperatures ranging from 0 F to 120 F. Both the old and the new equipment include control of humidity also. The room now in use is being employed at the present time in a study of the effect of environmental temperature on the riboflavin requirement of the pig. This experiment with this engineering equipment has shown much clearer than otherwise would be possible that low temperatures (40 to 45 F) do increase considerably the riboflavin requirement observed at higher temperatures (85 F), and it has the added advantage of associating a definite increase in requirement with a definite decrease in environmental temperature.

During the last World War this equipment was used in a study in human nutrition that was of interest to the Army. The problem studied may be stated as a question: Do troops stationed in a tropical environment, where sweat production may amount to a quart an hour or more, lose considerable amounts of water-soluble minerals and vitamins in the sweat? We found that, while sweat contains all of the water-soluble vitamins and the minerals found in the blood, insofar as our studies extended, in most cases they are present in such small amounts as to be inconsiderable in comparison with the day's requirements, with two exceptions—calcium and iron. These results suggest that the calcium and iron requirements of man may be increased by sweating, unless the kidney output is correspondingly reduced. On this point, more information is needed.

Experience with men exposed to controlled tropical environments has revealed enormous losses of water in the sweat, up to 12 quarts daily, and large losses of salt, especially in unacclimatized subjects. It has been shown that for men working in the heat, the continuous replacement of water losses is essential for continued operational efficiency. On the other hand, salt losses may be replaced at meal time when the meal is normal in its seasoning with salt. The trend in modern nutritional research in tropical environments is against the need or advisability of administering salt to men working in the heat, either in tablet form or as salinized drinking water, except possibly in the case of unacclimatized men. The modern view is well stated by a group of workers at the Harvard Fatigue Laboratory in the following words: "It would appear from the present experiments that in the case of well-acclimatized young men, whose daily diet is adequate, the best performance of intermittent work in the heat is to be achieved by replacing water loss hour by hour and salt loss meal by meal."

Increasing Resistance of Body

Another way in which nutrition may be related to the physical environment is that dietary modifications may increase the resistance of the body to climatic aggression. The cold room installed at the College of Medicine of the University of Illinois in Chicago in 1942 was used in an extensive war project of this type. Men on different types of diets were exposed to a temperature of 20 deg below zero for eight hours each day and five days a week; they were protected with a slightly inadequate assemblage of clothing. Their tolerance to cold was measured by physiological and psychological tests performed in the cold room. A distinct superiority of carbohydrate and fatty foods over protein foods in protecting the men against cold damage was clearly shown. Excess vitamin doses above the requirements in the comfort zone were not observed to exert any appreciable favorable effect on tolerance to cold, with one minor exception.

What's the Effect of Altitude?

The nutrition of populations living at high altitudes, as contrasted with populations living at or near sea level, has been studied sporadically through the years with not too clear results. But with the advent of the airplane as a method of transportation and as an instrument of war, it was imperative to study the question further, in a more precise manner and at much higher altitudes than are attainable at the earth's surface. Again the engineer was called upon to provide the necessary equipment—the decompression chamber with temperature control. During the last war many of these chambers were built by government agencies and other research institutions to study all of the problems of altitude and the accompanying low oxygen pressures.

Part of this research program was devoted to nutritional problems, using both laboratory animals and human subjects, since no laboratory animal yet tried has proved to be a reliable analogue to man in his nutritional response to decompression.

Some interesting information has emerged from this intensive research on the relationships between nutrition and diminished atmospheric pressure. Dietary requirements do not seem to be appreciably altered at altitude, except that the need for food energy is diminished merely because the work capacity of a man is lowered as well as his desire to work and his endurance to work. The most outstanding outcome of these studies is the favorable effect of carbohydrate foods, starches and sugars, on tolerance to altitude. High carbohydrate pre-flight and in-flight meals as compared with high protein meals may increase tolerance to altitudes within the range of 15,000 to 17,000 ft by the equivalent of 2000 ft. The ingestion of starchy foods and sugars immediately before and during flight to altitude increases mental efficiency, neuromuscular coordination, the capacity for muscular work, the field of peripheral vision and the acuity of vision in dim light. It defers blackout at high altitudes when the oxygen inhalation system is disconnected and decreases the severity of the symptoms of decompression sickness.

The acceptability of foods changes at altitude as compared with ground level, and it is interesting to note that sweet foods and beverages that exert favorable effects on altitude tolerance are preferred. Candy snacks, preferably sugar candy, might wisely be provided for prolonged flights. [The Food and Container Institute for the Armed Forces of the Quartermaster Corps issued in November 1949 a monograph by H. H. Mitchell and M. Edman entitled Nutrition and Resistance to Climatic Stress, with Particular Reference to Man. This monograph reviews critically all investigational work of this character, published and many unpublished, with 710 literature citations.]

Other Problems Remain for the Future

But the control of temperature, humidity and air pressure by engineering devices does not yet permit the exact duplication in an experimental chamber of the weather conditions with which animals and men must contend in actual life. In a cold environment, increased air motion will intensify the physiological effects of cold. In a warm environment, it may alleviate the damaging effect of heat, but only if the humidity of the air is appreciably less than saturation.

Another factor in climate that is difficult to duplicate in an experimental chamber is insolation, or exposure to the rays of the sun. I have been informed by a competent biophysicist that no artificial source of light has yet been designed that will duplicate the sun's rays in spectral composition. The problem is further complicated by the fact that the intensity and spectral composition of sunlight vary diurnally in different seasons and at different altitudes. There is a rapid absorption of total solar radiation, and particularly of ultraviolet radiation, from the stratosphere to sea level. The ultraviolet rays are responsible for the nutritional value of sunlight with reference to the function of vitamin D in the body. Dietary factors are also involved in the photosensitivity and photoresistance of animals and man.

There are advantages in maintaining a constant physical environment in factoring the effect of climatic aggression on nutritional processes. However, there may be special problems involved in the rhythmic changes in temperature, humidity, solar radiation and air motion characteristic of a day in either a polar or a tropical region. Automatic production of these diurnal weather rhythms in experimental chambers is a problem that engineers may be called upon to solve in the future.

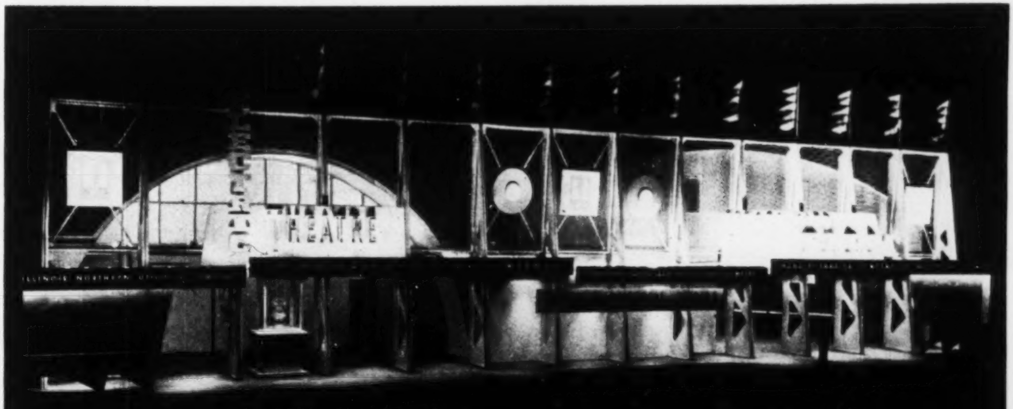
Environment an Important Item

Without subscribing to the thesis of Mills that temperature is dominant in human life and that "man is in reality a pawn of the environmental forces encompassing him", we may still believe that the physical environment is an important item in directing physiological processes of the body, including nutritional processes, and that the nature of the food supply of domestic animals and of man may modify the impact of climatic aggression. In solving the many problems involved in these relationships, the engineer must design the precision equipment for environmental control and must adapt it to specific problems and maintain it at maximum efficiency.

The physiologist, psychologist and pathologist must cooperate with the nutritionist in measuring the biological responses to environmental stress and in interpreting these responses in terms of general principles. The presence of the physician in human experiments in this area of research is essential in order to minimize the hazards to life and health inherent to some degree in such experimentation. The study of the interrelations of animals and their environment, putting animal ecology on an experimental rather than an observational basis, thus requires a team of workers with training in various sciences and technics for its successful prosecution.

[This article is based on a paper given before the 63rd annual convention of the Association of Land-Grant Colleges and Universities and unavailable elsewhere in published form.]

Temporary Fair Buildings Need Air Conditioning



The Electric theater at the Chicago Fair was cooled by three air conditioning units, aided by a roof spray system supplied with water from Lake Michigan, some 150 ft away

According to the management of Toffenetti's air conditioned restaurant at the Chicago Fair of 1950—which closed last month after a successful summer—"people walked from the extreme ends of the fair grounds to eat in our restaurant. It was amazing to see how anxious people were to get in out of the heat and dirt."

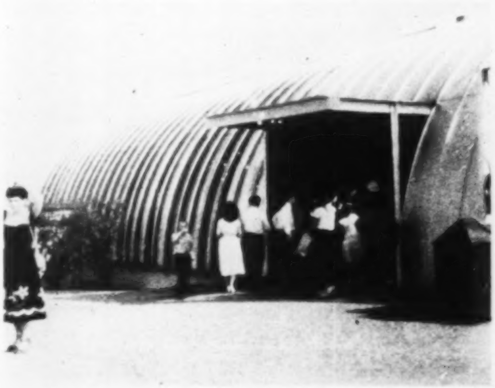
One of the reasons this air conditioning installation drew attention was showmanship. The air conditioning equipment was exhibited at the front of the restaurant behind walls of glass. Large signs announced it was operating to clean and cool the air in the restaurant. At night, spot lights illuminated the machinery.

Small signs tagged different parts of the equipment. There was the six cylinder hermetically sealed compressor, the 25 hp refrigerant cooled motor with its magnetic starting switch, an oil pressure gage, an oil level glass, a pressure equalizing line, a 50 percent capacity control valve, a liquid sightglass, air filters, outdoor air dampers with an outdoor air control, a 5 hp fan motor with its magnetic starting switch and fan drive, etc.

Since the restaurant was usually so crowded that there was a waiting line, customers had a good opportunity to study the air conditioning system.

The restaurant's capacity was 275 customers, and an additional 125 could be seated on the terrace. It was noticed that customers enjoyed sitting on the terrace when the weather was cool, the humidity low and there was no wind, but this is a rare combination on Chicago's lakefront! Toffenetti's restaurant served between 3000 and 3500 customers a day during the Fair, and attributes a great deal of this popularity to the air conditioning.

Water running down the theater from the roof sprays attracted fair visitors. Neighboring exhibitors found attendance increased when the sprays were on



Roof sprays were used on the quonset type hut housing the Electric theater—sponsored by the Commonwealth Edison Co., the Public Service Co. of Northern Illinois, the Western United Gas and Electric Co., and the Illinois Northern Utilities Co. — at the Chicago Fair to reduce the load on the air conditioning installation.

Roof Sprays Cut Cooling Load

The theater seated about 200 people, and was the only completely air conditioned theater at the fair. At the rear of the auditorium were three 5 hp package air conditioning units. Condensing water to these units and spray water for the roof was supplied by a 3 hp centrifugal pump which furnished 80 gpm—20 to the air conditioners and 60 gpm to the 17 roof sprays.

The pump operated at a 70 ft head. A 3 in. suction pipe extended about 3 ft under the surface of the lake and had a foot valve, strainer and screen at the intake. There was a plugged tee near the pump for priming.

The 3 in. pipe from the pump to the theater was buried in a shallow trench. At the back of the building it teed off to the roof with a 2 in. runout to the sprays and a 1-¼ in. pipe to the air conditioning units.

The water was returned to the lake through a 3-½ in. pipe. The distance from the lake to the units was 150 ft, and from the level of the lake to the sprays on the roof was 22 ft, 6 in. The length of the theater was 54 ft.

The roof sprays caused interesting and unlooked for results. Water spraying into the air and pouring down over the sides of the building attracted visitors to this section of the grounds. In fact, nearby exhibitors noticed that attendance at their shows was improved when the sprays were on, attracting people to their vicinity.

The air conditioning load was calculated for a 20 deg temperature differential as follows: Occupancy, 200 people, 7 tons. Ventilation, outside air, 7-½ tons. Electric load, lights and motors, 2 tons. Conduction, ends, base of building, 1 ton.

If the top and sides of the theater hadn't been sprayed with lake water, an additional 8-¼ tons of cooling would have been required. Since the sprays on the roof were so obvious, and the package air conditioners so inconspicuous, it was not uncommon for people to think the sprays did all the cooling.

The operators of the theater report that the air conditioning itself was a good drawing card. The doorways of the theater were covered only with cloth drapes and when people passing by felt the cool, refreshing air, they were anxious to go inside to relax in comfort while being entertained by a demonstration of the marvels of electricity.

The building adjacent to the theater housed displays of electricity at work on the farm. This building was ventilated by two 21,000 cfm exhaust fans forming part of the display, and labelled as being fine for barn ventilation.

Protects Demonstrators at Atomic Show

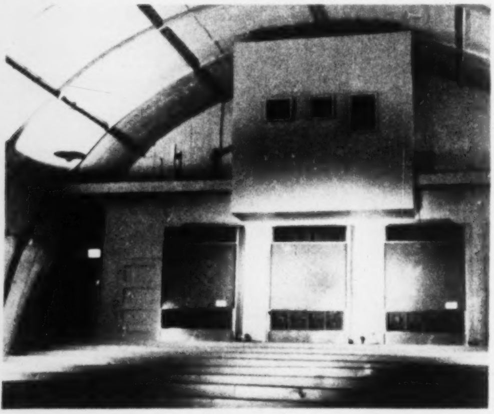
Human lives actually depended on air conditioning at the Chicago Fair Westinghouse theater. It prevented demonstrators from being electrocuted. The equipment displayed on the stage generated some high voltages and to keep the charges from jumping through the air, dehumidification was necessary.

The stage was separated from the auditorium by a glass partition installed at an angle to prevent reflections. This permitted air on the stage to be treated without influence from surrounding conditions.

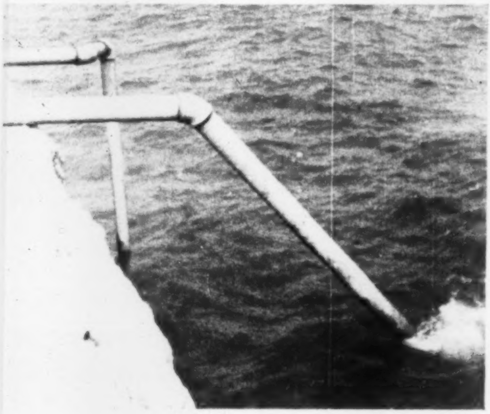
The 10 ton air conditioner was located in attic space above an anteroom next to the stage. Air was circulated through filters, cooling coils at a low temperature to remove the moisture, and then the air was reheated and discharged to the stage through overhead diffusers. Conditions maintained on the stage were 68 F and 52 percent relative humidity.

One of the dangerous pieces of equipment demonstrated was the world's largest Geissler tube, which was custombuilt for the fair. Such

These three air conditioning units at the rear of the theater were so inconspicuous to the average visitor that most of them gave all credit to the roof sprays for the cool atmosphere



If only all water supply and disposal problems for air conditioning installations were as simple as this! A pipe took water from the lake, and another pipe returned the water



EVEN BUILDINGS to be used for only a few weeks—as those at the big Chicago Fair of 1950, which attracted 1,709,004 visitors to its lakefront site last summer—need air conditioning to fulfill their objectives. Our reporter rambled around the grounds, picked up the accompanying information on how air conditioning performed at the fair, the kind of equipment used

tubes are used for atom research, and this one demonstrated atom agitation. As a safety precaution, red ribbons were used to rope off an area around the tube on the stage so no one would accidentally get near it.

Also dangerous was the van de Graaff generator, an authentic working model of an atom smasher. With the air dehumidified so electricity would not leak between the terminals, the generator would develop 300,000 volts.

At this high voltage, even air—normally an excellent insulator—cannot prevent the spark from leaping between the terminals. With moisture in the air, the spark will occur at a lower voltage.

The lecturers explained that lightning rods drain electricity out of the air as a continual process; they don't discharge large quantities intermittently with bright flashes and loud noise as so many people believe. These two methods of electrical discharge were demonstrated.

At the beginning of the season, the auditorium was uncomfortably warm. Exhaust fans and ducts were installed to remove the hot air overhead. This seemed to take care of the matter because there were few further complaints from the audience.

The auditorium seated 540 and there was room for 110 standees. Daily attendance averaged 6000, and many performances were so popular that not even standing room remained.

The purpose of the demonstration was to show peaceful uses and applications of atomic energy. The show received national recognition and was featured by newspapers, magazines, newsreels and TV.

First Aid Station Air Conditioned

There's lots of excitement at a good fair. Only sometimes people at the Chicago Fair got too excited. They'd go too long without eating, or overdo trying to see too many exhibits in one day. As a result they'd suffer from nausea or heat exhaustion.

Then one of the many attendants would 'phone Johnson & Johnson's first aid station right on the fair grounds. Immediately the ambulance would pick up the ailing visitor and take him to the air conditioned building. Here there were two wards, each having three beds and a 1 hp console air conditioning unit.

Many times after the patient had received treatment, he'd hesitate to leave, explaining that it was so cool and pleasant inside he'd like to rest a little while. Of course the additional relaxation and quiet environment with its conditioned air was an added benefit and helped prevent a relapse.

In addition to the air conditioners in the two wards, there were 1 hp console units in the reception room and in the treatment room for the comfort of the personnel. There were always two nurses, one doctor, one receptionist and one ambulance driver on duty. The ambulance drivers were medical students and doubled as first aid assistants. Work was divided into three shifts.

Outnumbering the cases of heat exhaustion were calls for adhesive bandages and aspirin. There were a few faintings, sprained ankles and children with skinned knees.

Employees at the fair used these first aid services too. Their cases were usually more serious, but they were handled just as efficiently.

The number of patients varied from 15 to 127 a day, the season's average being 65 patients a day.

At the Westinghouse theater, featuring applications of atomic energy, the enclosed stage was air conditioned for the benefit of the demonstrators, and the auditorium was ventilated

The Johnson & Johnson exhibit comprised a first aid station, with comfortable wards, a reception room and treatment room all served by 1 hp console units

Methods of Making PIPING FLEXIBILITY *Analyses*

How to Design Piping With Required Flexibility

In designing piping systems, it is important that adequate provision be made for the changes in length which occur in the pipe as a result of thermal expansion. Many engineers have need of a quick and easy method for checking the flexibility of three dimensional piping systems.

A simplified method, subject to some inaccuracies, has been described by C. T. Mitchell in the Transactions of the American Society of Mechanical Engineers, FSP 52-25, 1930. The author has reviewed the theory supporting this method, the limitations of the method have been analyzed in detail, and further simplifications to the method are proposed. These simplifications should very materially shorten the calculating time and improve somewhat the accuracy obtained.

The problem of calculating the flexibility of a piping system is inherently complicated, and most writers on the subject have stressed accuracy to the extent that many of the calculating methods described in the literature are unwieldy as applied to many problems encountered in everyday practice. Moreover, most engineers do not solve problems of this type often enough to develop the discipline required to obtain accuracy in a very tedious calculation—and, in order to get the job out on time, it is necessary to do a lot of intelligent guessing and only a minimum amount of calculating.

It is the purpose of this article to present a short-cut method for calculating the flexibility of three dimensional piping systems. Obviously, the method is also applicable to two dimensional systems.

Why Short-Cut Methods Are Needed

To illustrate the need for a quick and easy method, the author recalls a problem where it was desired to increase the efficiency of a considerable number of turbines and engines, installed at random locations throughout a large process plant, by supplying superheated steam through an existing piping network formerly operated at the saturation temperature. It was necessary to check 25 or 30 rather complicated piping configurations for safe operation at a higher temperature than had formerly been employed. In a few cases, it was necessary to make slight alterations to the piping to provide increased flexibility for operation at the higher temperature.

If the designer had attempted to use any of the more accurate methods currently described in the literature, the design costs would have been prohibitive, and probably the project would never have been undertaken. The above incident is recalled to emphasize the need for a quick and easy method for calculating the flexibility of piping systems.

It is recognized that slight concessions in accuracy must be made in order to simplify the calculation. The problem is to develop a simplified method which may be used by inexperienced calculators with a minimum of time consumed and with a minimum sacrifice in accuracy in the result.

In Table 1, the author makes a

Table 1—Comparison of four methods of calculating the flexibility of a piping system

	Accuracy	Estimated time to solve example No. 2 at end of this article
Grapho—analytical method (see Piping Handbook, by Sabin Crocker)	Good	4 days
Speilvogel	Good	3 days
Mitchell	Poor	1 day
Method proposed in this article	Fair	4 hours

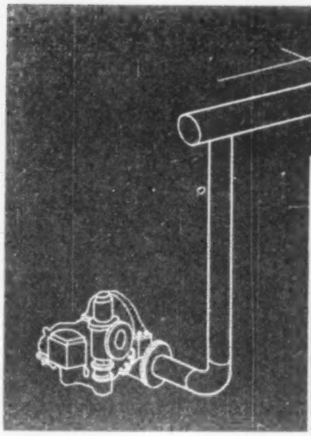


Fig. 1 *(left)*—A stiff arrangement of piping between a header and a turbine exhaust

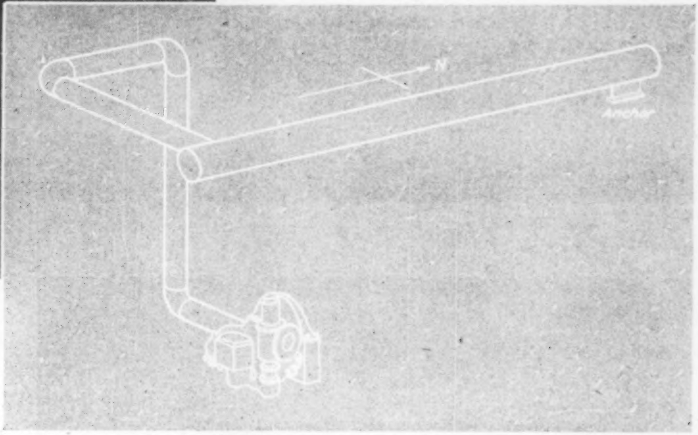


Fig. 2 *(right)*—How the exhaust piping in Fig. 1 could have been made more flexible if the piping had been completely rearranged early in the design

rough appraisal of the calculating time and accuracy of four methods for calculating the flexibility of a piping system.

Consider Early in Piping Design

It is very important that flexibility be given consideration in the initial stages of piping design. It is often very costly to make required changes late in the design, whereas it would have cost virtually nothing to provide the required flexibility early in the design.

For example, the piping shown in Fig. 1 is very stiff and requires attention. If such a condition is discovered after drawings have been completed and after the equipment has been ordered, it is often very difficult to correct the trouble. In Fig. 1 the piping expands in all directions from the anchor; that is, south, west and downward. It is usually not possible to correct such conditions by simply providing expansion joints. Both sides of each joint must be anchored to carry pressure thrust, and frequently the addition of an expansion joint will increase the thrust on the turbine.

It is rather suggested that the piping be radically rearranged to provide flexibility by adding as much pipe as possible remote from the thrust axis as was done in Fig. 2. In this way, the thrust on the turbine is greatly reduced and flexibility is provided for expansion of the pipe in all directions. It can be seen that it might be difficult to make such changes in the final stage of the design process.

As has been indicated previously, it has been necessary to make some concessions in accuracy in order to reduce the time required to make the calculation. It is therefore necessary to use a generous factor of safety when employing this short-cut method. It is often cheaper to increase the factor of safety than it would be to refine the calculation. In addition to employing a large factor of safety, it is recommended that the reader study the following review of the theory, in order that he may understand the limitations of the method.

Review of Flexibility Theory

The theory supporting the Mitchell method of figuring piping flexibility will be very briefly reviewed. As far as the pipe is concerned, the same forces and stresses are produced if we assume that the pipe does not expand, but that one anchor is moved an equivalent amount toward the other. It is a little easier to visualize the flexing of the pipe if we assume that the anchor is moved rather than that the pipe expands.

No matter how complicated a pattern of restraining forces and moments are generated at the anchor, they may all be resolved into a single resultant force acting on the pipe. The line through which this resultant

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THEODORE E. BRIDGE acquired a wide experience in the design of power and process piping during 15 years with E. I. du Pont de Nemours & Co., and has also had experience in the field of very high pressures. At the time he prepared this article, he was a mechanical engineer with the University of Chicago in connection with a project under construction for the Argonne National Laboratory; he is now associated with Tube Turns, Inc. He has taught several other engineers to use the method described here in figuring flexibility of piping systems, and they have found it as useful as has he

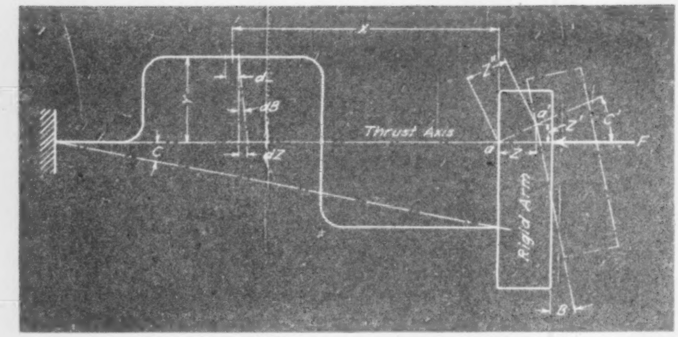


Fig. 3—The effect produced by the applied force acting on an element of pipe parallel to the thrust axis

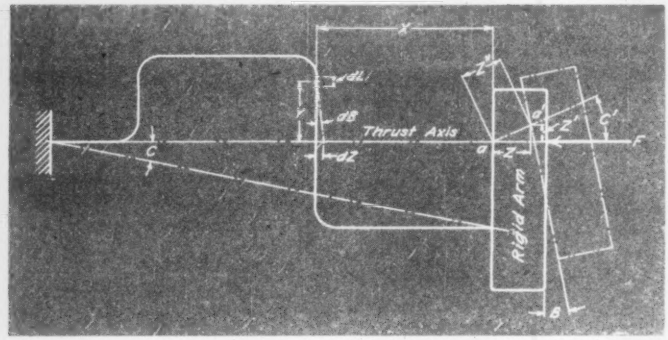


Fig. 4—The effect produced by the applied force acting on an element of pipe perpendicular to the thrust axis

force acts will be called the thrust axis.

A simple two dimensional piping system is shown in Fig. 3, and the thrust axis is drawn on the sketch to aid in visualizing the flexing of the pipe. The left end of the pipe is shown as anchored, but the anchor at the right end has been replaced by an imaginary rigid arm. When the resultant force F is applied to the rigid arm, the pipe will bend, causing a deflection Z at the rigid arm in the direction in which the force is applied. In solving a problem, the deflection of the rigid arm, under the action of the applied force F, is made equal to the expansion of the pipe between anchors.

It is now possible to consider the effect of the applied force on a very small element of the pipe with the length dL and located a distance Y from the thrust axis. It is obvious that the bending moment on the element of pipe dL will be

$$m = F\,Y \qquad [1]$$

where m is the bending moment on the pipe, ft-lb.

It can be shown, by referring to the basic beam theory in any elementary text book on applied mechanics, that the change in slope of a short element of a beam is equal to $(144\,m\,dL\,/\,E\,I)$, where E = Young's modulus of elasticity, psi, and I = the moment of inertia of the pipe section about an axis through the center of gravity of the section, in.^{4} This change in slope is often called "angle change." In Fig. 3, it is represented by angle dB. Therefore,

$$dB = 144\,m\,dL\,/\,E\,I \qquad [2]$$

Substitute [1] in [2]:

$$dB = 144\,F\,Y\,dL\,/\,E\,I \qquad [3]$$

The angle dB is measured in radians. Therefore, the effective motion of the rigid arm at the thrust axis resulting from the angular displacement dB will be $(Y\,dB).dz = Y\,dB = (144\,F\,/\,E\,I)\,Y^2\,dL$. Integrating,

$$z = (144\,F\,/\,E\,I)\int Y^2\,dL, \text{ and}$$
$$Z = (1728\,F\,/\,E\,I)\int Y^2\,dL \qquad [4]$$

where z = the deflection of the rigid arm parallel to the thrust axis, ft.
and Z = the deflection of the rigid arm parallel to the thrust axis, in.

In Fig. 4, a similar system is shown in which the element of pipe

Symbols

B is the angular displacement of the rigid arm under the action of the force F, radians.

C is the angle between the thrust axis and a line joining the anchors.

C' is an angle defined by the equation, $\tan C' = Z'/Z$.

dB is the differential angle change resulting from the bending moment m acting on the differential length dL, radians.

dL is the length of a very short element of pipe, ft.

dz is the deflection of the rigid arm produced by bending in the element of pipe of length dL, ft.

e is the coefficient of expansion of the material of which the pipe is made. (For steel, e = 0.00000625 per F).

E is the modulus of elasticity of the material in the pipe, psi. For steel, E = 29,000,000 psi. This value decreases as the temperature rises, but the value for e increases with rise in temperature. These two terms are always multiplied together, so that no correction for changes in temperature need be made for steel for all temperatures below 600 F.

F is the force applied to the rigid arm to simulate the effect of anchoring the pipe.

G is the modulus of rigidity of the material in the pipe, psi. For all materials, $G = E/2(1 + n)$.

I is the moment of inertia of the pipe cross-section, in.^{4}

L is the length from one end of a straight section of pipe to the element of pipe dL, ft.

m is the bending moment on the element dL, ft-lb.

M is the moment area, ft.^{3} $M = \int_o Y^2\,dL$

n is Poisson's ratio. For most materials, including steel, n = 0.3.

X is the distance from the rigid arm to the element of pipe dL measured along the thrust axis, ft.

Y is the perpendicular distance from the element of pipe dL to the thrust axis, ft.

z is the deflection of the rigid arm measured in the direction parallel to the thrust axis, ft.

Z is the same deflection as z except that it is measured in inches.

Z' is the deflection of the rigid arm measured perpendicular to the thrust axis, in.

Z'' is the vector sum of Z and Z', in. When the thrust axis is correctly located, it is equal to the expansion of the pipe.

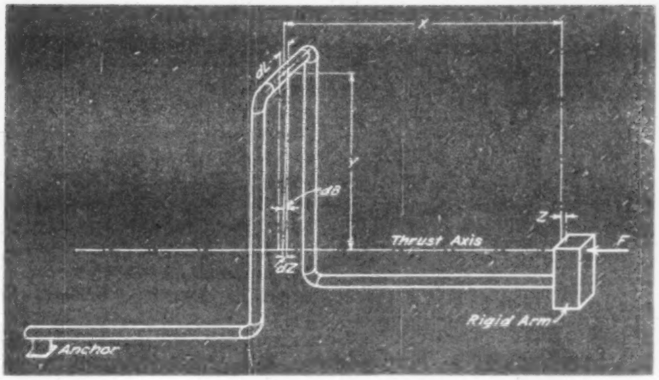


Fig. 5—The effect produced by the applied force acting on an element of pipe in pure torsion

dL is in the same plane with the thrust axis, but it is perpendicular to the thrust axis and not parallel as it was in Fig. 3. It will be readily seen that equations Nos. 1, 2, 3 and 4 apply quite as well to Fig. 4 as they did to Fig. 3. Thus it is seen that, no matter how the pipe is oriented in the plane with the thrust axis, the same formula may be used in calculating its flexibility.

It is now advantageous to consider the effect of force F on an element of pipe which is perpendicular to the plane containing the thrust axis and the element of pipe. This condition is shown in Fig. 5. In this figure, the element of pipe is in pure torsion. Equation 1 applies as before ($m = F\ Y$) but equation 2 must be rewritten:

$$dB = 144\ m\ dL / G\ Ip \ldots\ldots [5]$$

where G is the modulus of rigidity of the material and Ip is the polar moment of inertia of the pipe section. However, $G = E/2\ (1 + n)$, where n = Poisson's ratio.
For most materials including steel, $n = 0.3$.

$$G = E/2.6 \ldots\ldots [6]$$

$$Ip = 2\ I \ldots\ldots [7]$$

Substitute [1], [6] and [7] in [5]:

$$dB = 144\ F\ Y\ dL\ 1.3 / E\ I \ldots [8]$$

Also

$$\begin{aligned} dz &= Y\ dB \\ &= (144\ F/E\ I)\ 1.3\ Y^2\ dL \end{aligned}$$

and integrating,

$$z = (144\ F/E\ I)\ 1.3 \int Y^2\ dL \text{ or,}$$
$$Z = (1728\ F/E\ I)\ 1.3 \int Y^2\ dL \ldots [9]$$

It is seen by comparing equation 9 with equation 4 that straight pipe in torsion has 30 percent more flexibility than pipe in pure bending. It will greatly simplify the calculation, and it will add some to the factor of safety, if this factor of 30 percent can be disregarded. Thus it has been shown that, if an element of pipe is oriented parallel to any of the three major coordinate axes, the same formula may be used to calculate its effect on the flexibility of the system. It is obvious that the same formula will also apply for any orientation intermediate to the three axes considered above; or, in effect, the same formula will apply for any orientation whatever. In other words, the orientation of the pipe may be ignored and the following formula may be used to calculate flexibility no matter how it is tilted with regard to the thrust axis.

$$Z = 1728\ F\ M/E\ I \ldots\ldots [10]$$

where

$$M = \int Y^2\ dL \ldots\ldots [11]$$

Mitchell gave equation 10 in his original paper, and he presented a graphical method for calculating the function M in equation 11. The derivation of the equation was not given. The derivation has been included here to assist in understanding the limitations of the method and to aid in explaining further simplifications which will be made to his original method.

[To be continued.]

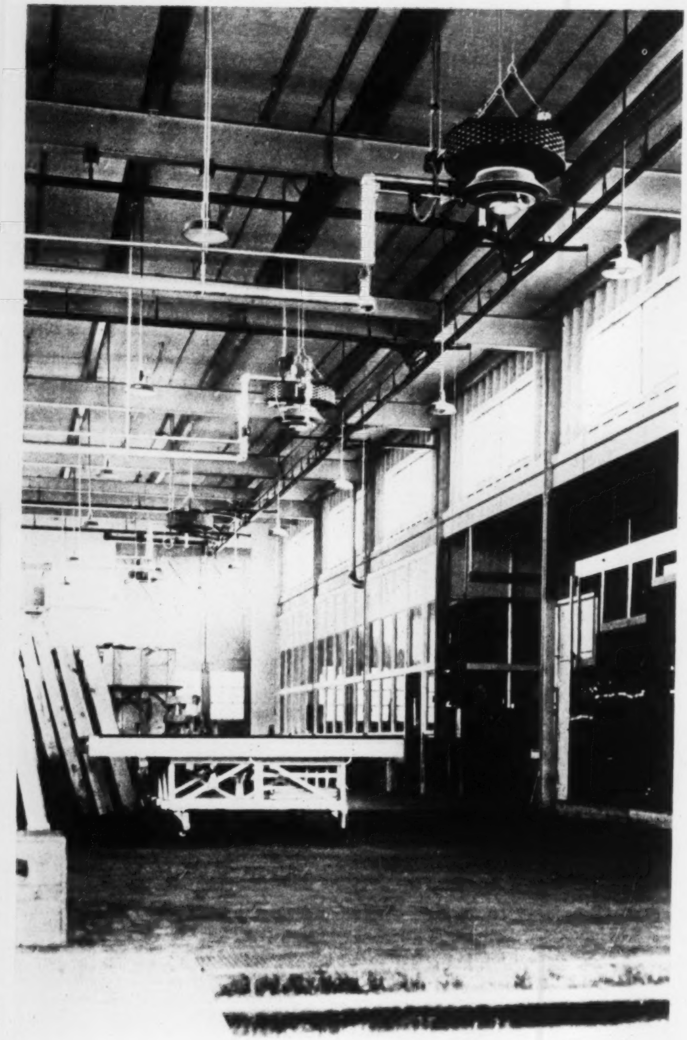
STEAM PIPED TO ANIMATE BILLBOARD

STEAM AT approximately 15 lb pressure is piped to a billboard at the Baltimore plant of Recipe Foods, Inc., to make a simmering kettle in an advertisement for chili sauce. A 3/8 in. line runs from the boiler to a section of 4 in. pipe in the kettle. The top of the 4 in. section is drilled and 1/8 in. nipples protrude to the top of the kettle, through which the hot vapors emerge to give the appearance of a boiling pot.

Condensation is returned from the 4 in. section through a steam trap to the boiler feed.

THE REAL HOME-MADE KIND...
mm-m
BENNETT'S CHILI SAUCE

Steam piped to this billboard emerges from the kettle to animate the advertisement for one of Recipe Foods products



Using Ceiling Heat With Unit Heaters

High ceilings often mean high heating costs, but in many industrial plants and commercial buildings high ceilings are necessary to provide space for overhead cranes, conveyors, and large assembly operations or for other reasons.

While sawtooth, hip, monitor, high bay and other roof designs have many functional advantages, they generally consume or waste tremendous amounts of heat. Temperature variations as high as 40 deg have been recorded between the "waste" zone near the ceiling and the "comfort" zone, the 8 to 10 ft immediately above the floor, where most work is done.

Introduction of vertical discharge (projection type) unit heaters about 10 years ago was one important step toward solving the problem of waste heat in industrial and commercial buildings. Installation of such units at relatively high positions has permitted utilization of the warm layer of air near the ceiling, reducing the amount of steam or hot water required to heat the comfort zone. Performance of the projection type unit heaters has been improved continually by development of various types of diffusers, which may be adjusted to direct the flow of warm air wherever needed to attain efficient heating in the comfort zone near the floor.

Utilizes Warm Upper Air

Despite these constant improvements in vertical discharge unit heater design, some installations fail to utilize completely the warm air near a high ceiling. The units are controlled generally by a manual off-on switch, which is turned on at the beginning of the day and shut off when heat is no longer required. Or a standard thermostat near the floor turns the unit's fan on and off in accordance with the heat demands of the comfort area. In either event steam is on constantly, whether the fan is running or not.

The versatility and efficiency of vertical discharge unit heater installations can be increased substantially by the adoption of a dual control or temperature equalizing system.

The dual control system does more than the single control set-up. The latter depends on the comfort zone regulator only. As the entire area comes up to this temperature setting, the ceiling area accumulates a great deal of heat. The floor area may be perfectly comfortable as a result of the projection heater's ability to push the warm air down to the living zone. The air mass is completely circulated also. The trick that would save fuel and tempers as well as temperatures is to get a good deal of the air above the 10 ft height back in to the comfort zone without additional heating. This is where the dual control system enters the picture.

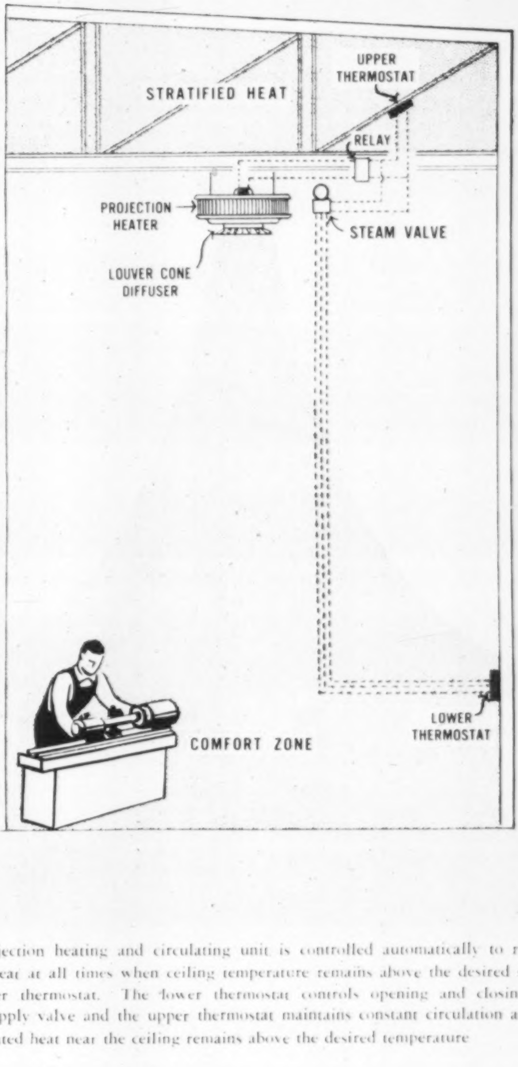
The temperature equalizing system embodies this dual control and takes full advantage of the versatility of the projection type unit heater. Warm upper air in the area is distributed to the comfort zone whenever needed. The system may be applied to individual units, or to groups of units when conditions are such that adequate zoning is possible.

Controls include two thermostats, a clamp on temperature controller, a motorized valve with auxiliary switch, and a contactor or relay to control the unit fan motor.

How Dual Control Operates

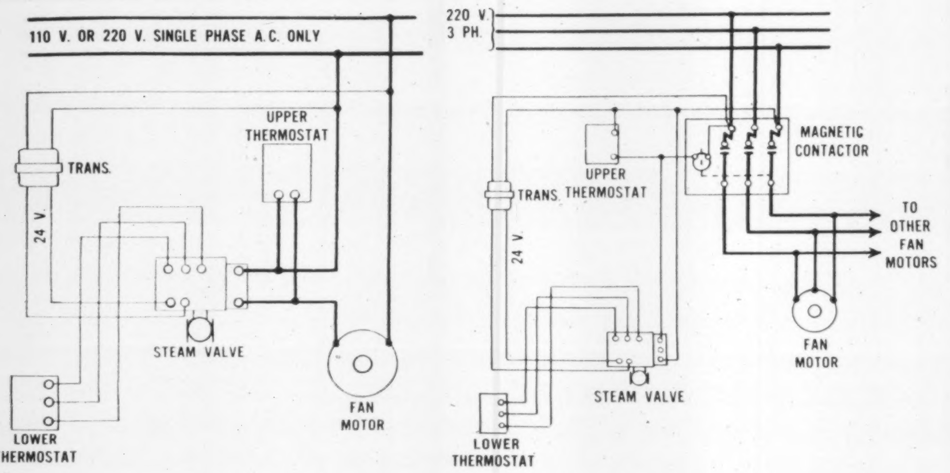
The first thermostat is mounted in the comfort zone about 5 ft from the floor. It operates the motorized valve when the temperature drops below that set. The motorized valve is mounted in the steam supply line to the unit heater. A slow opening steam valve or bleeder valve is necessary with high pressure steam lines to prevent water hammer.

As the valve is opened, the auxiliary switch closes an electrical circuit to the contactor relay. This energizes the unit heater fan. The fan is kept from running by the temperature controller in the return line if no steam is in the unit. A standard cooling type thermostat is mounted at the ceiling level, adjacent to the heater but away from the pipes. This second thermostat allows



The projection heating and circulating unit is controlled automatically to recirculate ceiling heat at all times when ceiling temperature remains above the desired setting of the upper thermostat. The lower thermostat controls opening and closing of the steam supply valve and the upper thermostat maintains constant circulation as long as accumulated heat near the ceiling remains above the desired temperature

R. E. LEE, manager of the unit heater department of The Trane Co., describes a dual control or temperature equilizing system for use with vertical discharge unit heater installations. An upper thermostat—in addition to a thermostat in the working zone—permits the unit to circulate warm air from the top of the space, although the steam or hot water supply to the unit is shut off



Left—Control diagram for temperature equalizing system for single unit, single phase, $^{3}/_{4}$ hp maximum. The lower thermostat closes the steam supply valve at any time temperature in the operating space has reached the desired level. An auxiliary switch on the steam valve will stop the fan motor unless the ceiling temperature is above the setting of the upper thermostat. In this case, the auxiliary switch is short-circuited by the upper thermostat and the fan continues to run until the temperature in the ceiling zone is reduced by recirculation
Right—Typical control diagram for temperature equalizing system using single or multiple units, three phase, or multiple units in single phase. Control operation is the same whether using single or multiple units. When the lower thermostat reaches the desired temperature for usable operating area it closes the steam supply valve. An auxiliary switch on the steam valve stops the fan motors supplying heat from areas near the ceiling. As long as the reservoir of heat near the ceiling remains above the setting of the upper thermostat mounted near the projection fans and heat supply, the fans continue to force the warm air down toward the floor operating area unitil heat is dissipated.

the fan to operate even when the first thermostat has closed the steam line. This operates as long as the temperatures at the ceiling level are high enough to provide a heating effect by recirculating this warm air which would normally stratify.

Then, when the floor thermostat calls for heat, both fans and steam supply swing into action. As soon as the proper temperature is reached, the steam is shut off and the fans continue their downward diffusion of the warm upper air. When the ceiling temperature drops, the ceiling thermostat stops the fans.

Adjustments should be made on the job for the temperature at which the projection heater fan will shut off to prevent the discharge of air from the ceiling zone at too low a final temperature.

It can readily be seen that this method of control promotes evenness of temperature, prevents overheating, and prolongs the period when no steam is required. Projection heating, an outstanding method of forcing warm air from tall heights, can serve better with dual controls.

REPORTS ON SMOKE ABATEMENT SURVEYS

REPORTS ON smoke surveys were completed recently by the Coal Producers Committee for Smoke Abatement for the cities of Winston-Salem, N. C., Flint, Mich., and Altoona, Pa.

In the Winston-Salem report, it was emphasized that considerable progress had been made in abatement of smoke since the control program was initiated, but that much more can be accomplished by cooperation and active support of all interests concerned with the problem.

In Flint, a special meeting of the city council and the chamber of commerce was held to hear H. B. Lammers, chairman of the committee, discuss the report. He told the group that a "major part of the air pollution now existing in Flint in excess of practical control standards of emission in effect in many cities is the result of carelessness in operating methods and indifference to the efficiency derived from fuels and equipment". Mr. Lammers recommended that arrangements be made by the city for classes and schools of combustion. "Such classes", he said, "might be included in the vocational school curriculum.

In Altoona, the committee found the predominant activity to be the railroad structures and equipment. In presenting the report, Mr. Lammers emphasized that the railroad facilities were not the only offenders. Nearly every plant surveyed by the engineers was smoking at the time of the visit and nearly everyone was improperly operated. In addition, half of the equipment had mechanical deficiencies and 60 percent were burning rubbish or waste.

DATA sheet

Stress and Deflection in Horizontal Pipe Lines

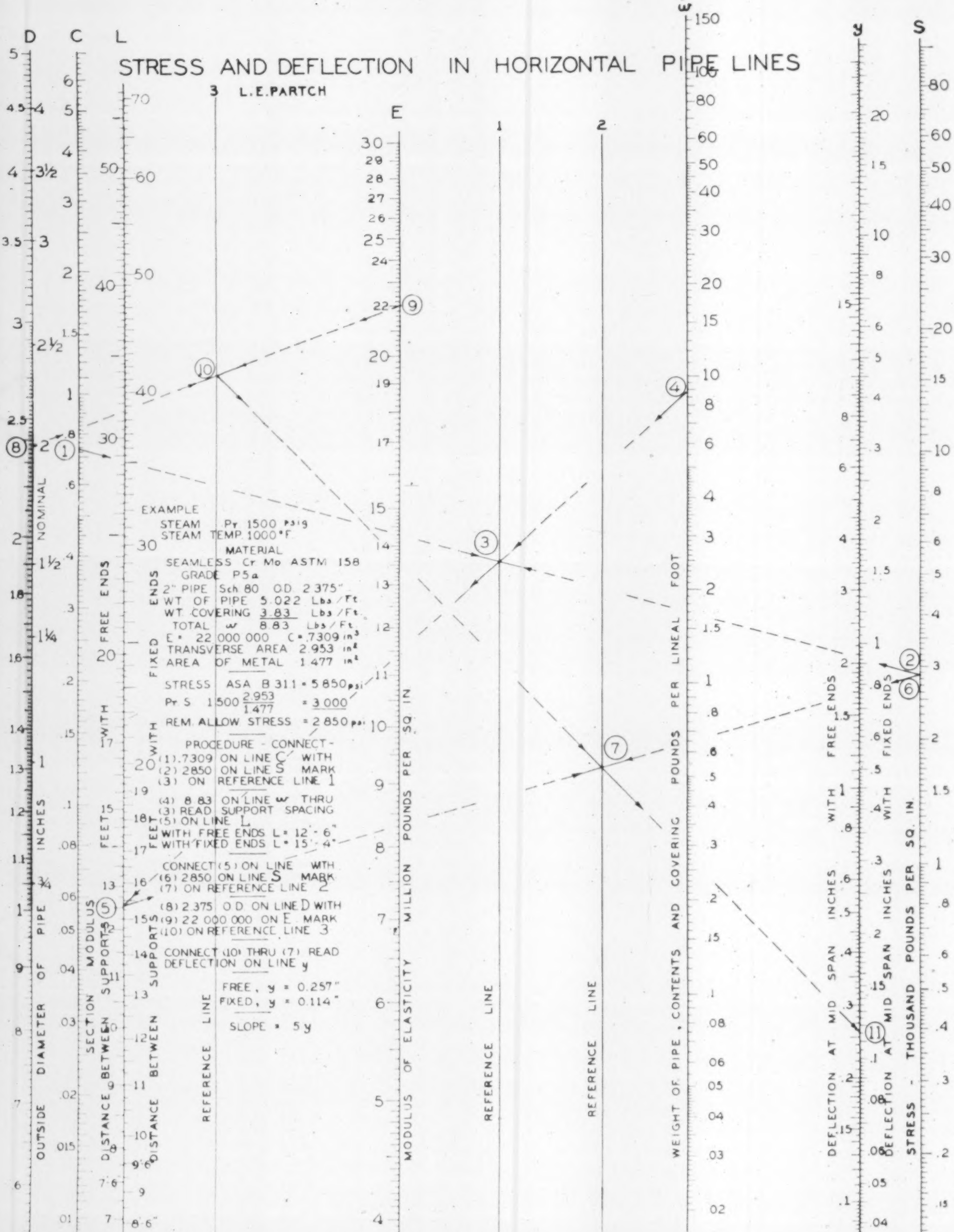
By L. E. Partch

THE nomogram on the next page for stress and deflection in horizontal pipe lines is a companion to the Data Sheet which appeared in the May 1950 HPAC for piping from 4 to 40 in. outside diameter. This second sheet covers a range of pipe sizes of from ½ in. up to 5 in. OD. An example is printed on the face of the chart to show its use in the spacing of supports for a 2 in. pipe subjected to high temperature and pressure.

This chart has been prepared by L. E. Partch. After graduation from the University of Michigan in 1917, Mr. Partch had five years of mechanical design experience at the Ford Motor Co. (special machines and furnaces). He was then engaged in power plant and process design at Wyandotte Chemicals Corp. up to 1926, after which he spent a year at The Detroit Edison Co. on piping design. He then returned to Wyandotte in charge of steam production (where the "practical" side of piping was observed). He is presently with Giffels and Vallet, consulting engineers.

STRESS AND DEFLECTION IN HORIZONTAL PIPE LINES

L. E. PARTCH



EXAMPLE

STEAM Pr 1500 psig
STEAM TEMP 1000°F

MATERIAL

SEAMLESS Cr Mo ASTM 158
GRADE P5a
2" PIPE Sch 80 OD 2.375"
WT OF PIPE 5.022 Lbs/Ft
WT COVERING 3.83 Lbs/Ft
TOTAL w 8.83 Lbs/Ft
E = 22 000 000 C = .7309 in³
TRANSVERSE AREA 2.953 in²
AREA OF METAL 1.477 in²

STRESS ASA B 31.1 = 5 850 psi

$$\text{Pr S } 1500\frac{2.953}{1.477} = 3\,000$$

REM. ALLOW STRESS = 2 850 psi

PROCEDURE - CONNECT -

(1) .7309 ON LINE C WITH
(2) 2850 ON LINE S MARK
(3) ON REFERENCE LINE 1

(4) 8.83 ON LINE w THRU
(3) READ SUPPORT SPACING
(5) ON LINE L
WITH FREE ENDS L = 12'-6"
WITH FIXED ENDS L = 15'-4"

CONNECT (5) ON LINE WITH
(6) 2850 ON LINE S MARK
(7) ON REFERENCE LINE 2

(8) 2.375 O.D. ON LINE D WITH
(9) 22 000 000 ON E MARK
(10) ON REFERENCE LINE 3

CONNECT (10) THRU (7) READ
DEFLECTION ON LINE y

FREE, y = 0.257"
FIXED, y = 0.114"

SLOPE = 5y

QUESTION of the Month

IN THIS REGULAR feature, specific questions on heating, piping and air conditioning which have been asked by HPAC's readers are answered both for the original "asker" and for others as well. The editors hope you'll find these practical comments of regular monthly interest, will contribute either questions or answers yourself when the occasion arises.

HOW TO VENTILATE DRYING OVEN

IN HIS QUESTION published in the September HPAC, "G.C." said that he would appreciate having information on the ventilation requirements in connection with the drying of cement used to fasten automobile brake linings to brake shoes. At a certain plant, a phenolic resin varnish is employed, drying being accomplished by a number of electric bulbs which emit a large amount of radiant heat.

In commenting on this question, the required ventilation rate for "pass-through" type drying ovens for painted, coated and cemented articles is dictated by two considerations. In the first place, it must be adequate to prevent the vapors released in the drying operation from escaping into the room air in harmful concentrations, and in the second place it must be adequate to keep the concentration of the vapor in the exhausted air from reaching an explosive level. If the liquid vehicle in the cement, paint or varnish is highly flammable, the second consideration may be the controlling one — otherwise the health hazard is the governing consideration.

Drying ovens usually take the form of a tunnel or room in which the heating units are located and through which the conveyor carrying the parts to be dried passes. The vapor released in the drying operation normally will not escape from the tunnel or room if it is exhausted at such rate that the velocity of air flow into all openings is about 100 to 150 fpm. Consequently, the normal exhaust rate for drying ovens is about 125 cfm per sq ft of opening into them.

Obviously, the total exhaust rates for drying ovens can be held to a minimum by proper design of the ovens so that the openings are as small as practicable. For small parts on a belt-type conveyor, this consideration can be carried to an extreme. For example, if the ends of the drying tunnel are closed so that only the belt and the articles on it can enter and leave, the total area of opening might well be only a fraction of a square foot and the resulting ventilation rate might approach or even be less than the rate of vapor production in the dryer. For this reason the exhaust rate should never be reduced below about 300 cfm or 10 times the rate of vapor produced, whichever is greater.

If there is considerable movement of any kind inside the drying room or near the open ends, higher exhaust rates are needed to keep the vapors from spilling out of the dryer because of the air turbulence created. For example, a person walking at the rate of 4 mph (350 fpm) or a motor truck of any kind moving by the open end of a dryer will cause some of the contaminated air to spill out unless the velocity through the opening is 200 fpm or more. This type of disturbance can be minimized by suitable shielding of the open ends of the dryer where movement is common.

If the vapors released in the dryer are explosive, the exhaust rate must be adequate to keep the concentration of them in the exhausted air below the explosive limit. In fact, it is common practice to calculate the exhaust rate so that the vapor concentration in the exhaust air will not exceed 20 percent of the lower explosive limit. Some solvents and thinners do not present an explosion problem but many of them do. To control the explosion hazard, it is necessary to determine the rate at which the liquid vehicle in the cement, paint or coating is used and to calculate the rate at which air must be exhausted to keep the concentration of the vapor below about 20 percent of the lower explosive limit. The lower explosive limits of many substances are given in the literature on fire prevention (for example, the publication entitled Properties of Flammable Liquids, Gases and Solids, published by the Associated Factory Mutual Fire Insurance Companies.)

The required ventilation rate to prevent explosive mixtures in the exhaust system is given by the expression $Q = 3255S/WE$, where Q = exhaust rate, cfm; S = consumption rate, lb per hr, of the liquid vehicle; W = gram-molecular weight of the liquid vehicle; E = lower explosive limit of the liquid vehicle, percent.

For example, calculate the required minimum ventilation rate for a dryer where cemented articles are dried in which the solvent is benzol and the average consumption rate is 5 gph of benzol. The gram-molecular weight of benzol is 78.1 and its lower explosive limit 1.4 percent. Five gallons of benzol weighs 36.6 lb. (sp. gr. 0.88). Hence, the required ventilation rate is

$$(3255 \times 36.6)/(78.1 \times 1.4) = 1090 \text{ cfm}$$

Even though the foregoing formula incorporates a safety factor of five, it does not eliminate completely the explosion hazard in the drying oven. If the liquid vehicle has a flash point lower than the temperature of the parts being dried when in the drying oven, an explosive mixture will exist at the surfaces from which evaporation is taking place unless the air movement over all drying surfaces is sufficient to keep the concentration of the evaporating vapors below the explosive limit. Auxiliary fans are sometimes used to maintain good air circulation in the drying oven in an effort to keep this hazard at a minimum. When this procedure is objectionable or impractical, sparks and fires should be kept away from the parts being dried to prevent minor flashes in the zone directly around the drying parts.—A.D.B.

CROSS CONNECTING REFRIGERATION MACHINES

THIS IS A possible solution to the air conditioning operating problem submitted by "R.A." and published in the July HPAC, page 109.

It may be that "Freon" condensing or otherwise gathering in the oil separators during shutdown of one or more compressors is sufficient to lift the separator float and admit liquid refrigerant to the crankcase. The installation of electric heaters on the oil separators can eliminate this. The heaters may be wired in such a way that they are on whenever a compressor is not operating. D.D.

WHAT'S THE RIGHT OFFICE TEMPERATURE?

WHAT TEMPERATURE to carry in offices is always a good question, is often difficult for the engineer to answer to the satisfaction of all the interested occupants. The employee publication of a large utility company has a regular department devoted to replies to employee questions, recently ran the following:

"Temperatures of from 78 to 80 deg now exist in many offices which are equipped with air conditioning. Temperatures of this range are too warm to be comfortable. More healthful temperatures are conceded by health authorities to be 70 to 72 deg. Open windows are ineffective for cooling during operation of the unit. Are temperatures of 78 to 80 an indication of normal operation of the conditioning system?"

The question was answered as follows:

"While it is true that health authorities consider 70 to 72 deg as adequate winter temperatures, experience in our office buildings has been that due to the necessary circulation of air required when space is air conditioned, it is difficult to maintain a temperature lower than about 75 to avoid the feeling of drafts. This is the temperature which has been standardized after very careful study and upon the recommendation of the architects and building engineers.

"When air conditioning is installed it provides a source of heating in addition to the existing direct radiation. When the air conditioning was installed in our main building it was necessary to revise the present direct heating system by installing orifices in the radiators to limit the amount of steam provided by that system, and consequently the conditions in this building have been normal.

"In our other office building, where an automatic system was installed some years ago, it was hoped that the system would operate adequately without remodeling it. It has been found, however, that it will be necessary to re-orifice this system, and contracts have been let to do that. When this is done it should be possible to maintain proper temperatures in the building."

Reader Asks for Aid in Solving Shampoo Process Piping Problem

YOU ARE invited to answer the following question, which has been submitted by a reader of HPAC who is the mechanical engineer with a large manufacturing firm. Suitable comment on the matter will be welcomed and—space permitting—will be published. Before you prepare your answer, read the comments on the same problem on Sam Lewis' Page in this issue, as an advance copy of the question was sent to Mr. Lewis. Address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"We are confronted with a problem for which there seems to be nothing but an expensive solution. Possibly HPAC's readers could afford a much simpler and more economical answer through the Question of the Month section.

"Our mixing kettles for shampoo are located on the 10th floor of one of our plant buildings. After a production run, the mixing kettles are thoroughly cleaned and the 300 to 500 gal of water used in cleaning all of the kettles is run directly into a 3 in. drain pipe which runs straight down into the basement where it makes a sharp turn and flows into the storm sewer. As the cleaning water hits the turn in the drain pipe in the basement, the shampoo begins to foam and backs up through the drain pipe through the two floor drains on each floor. The foam has backed up through the floor drains as high as the fourth floor.

"We realize that one solution would be to run a drain pipe from the 10th floor directly into the storm sewer without any floor drains on the lower floors. However, this would involve considerable expense.

"We are writing with the thought that possibly some of HPAC's readers may have had similar difficulties and might have comments and recommendations, which would be most welcome."—E.J.B.

Sam Lewis' Page

We keep calling this regular feature "Sam Lewis' Page" each month, although it generally runs to about two pages and sometimes to three. Guess we'll have to get around to making the title plural one of these days. No matter how long this department does run, however, it comprises informal comment on heating, piping and air conditioning matters by Samuel R. Lewis, well-known consulting mechanical engineer and member of HPAC's board of consulting and contributing editors. Some of the subjects he discusses are suggested to him by readers of this "Page", others are referred to him by HPAC's editors, and the rest come into his mind while he's waiting for an elevator.

HOW TO WRITE SPECIFICATIONS

A consulting mechanical engineer, starting practice, wishes for a check list or blank form for specifications, and has written for suggestions. Evidently he is not interested as much in the general conditions that provide for jurisdiction and that cover the relations between owner and engineer, as in some form that will help him not to omit the description of important items of construction.

He suggests that a committee of representatives from the major engineering societies might develop a concise form of specification. Perhaps his idea is to pick out from this printed list such items as he thinks will fit his particular job.

This somewhat lazy scheme has been tried before by me. In my youth, I hopefully purchased several voluminous books of specifications. The darn things never did seem to fit what I sought. The descriptions of various items in many cases were obsolete before they had been printed. Repeatedly, as the years flitted past, I would consult the digests, but usually I failed to find the answer I desired.

I feel that experience is the best teacher, and that my best guide in writing a specification for a particular project is the specification I wrote some time ago for a job that was like this one, that I know was built, and that went through successfully.

I find on many an old specification a note made during the construction, to strengthen and improve some passage in the specification for the next similar job, or to add some item that the actual experience showed to have been missed.

There is no royal short-cut road to a good specification. I hate to see the tendency, by some writers, to forget that our language has articles, such as "A" and "The".

It is apparently good practice to develop the specifications simultaneously with the drawings, or even to write them before completing the drawings. I like to do that very thing. Certainly, development of the specifications and the drawings should be simultaneous.

It is wise to describe the material of each item first, then to describe the manner of its blending into the structure. A specification should emphasize workmanship, while the drawings should locate the apparatus in relation to the structure and to the other services.

Occasionally one sees a drawing on which the designer attempted to print also the specification. This scheme cannot be very favorably endorsed, as it is generally impracticable to give the owner adequate protection without much more detail as to workmanship and character of materials than can be hand-printed around the edges of a drawing.

SHAMPOO FACTORY HAS SOAPSUDS TROUBLES

The chief engineer of a factory 10 stories and more high, prays for help because the soup-like mixture of water and soap that results from periodic washing out of shampoo-processing kettles at the 10th story causes sewer trouble.

When I scrub the bristles on my dome with good soft soap and water that is somewhat less lime-loaded than that which comes from most deep wells, a grand pile of bubbles and foam appears. In the bubble factory of our engineer friend, the soapy washout water, falling 10 stories, hits the elbows at the bottoms of the soil pipe stacks with so much force that the turmoil resembles that on my scrubbed head; and the soapsuds back up in the stack to a level as high as the fourth story.

Unfortunately there are floor drains and other sewer connections into these soil pipe stacks below the fourth story level, and the boiling, spreading, permeating soapsuds back out most embarrassingly through many outlets. Presumably the chief engineer hopes that some chemical solution might be added to the wash water when such water is wasted at the 10th story, to the effect that the thus-diluted shampoo will not shampoo! Realization of this hope seems somewhat doubtful to me.

My first thought is to suggest new soil stacks from the fourth story on down, but probably even this would be difficult and costly unless all of the 10th-story shampoo-mixing devices drain to a single stack. In that case, perhaps the waste connections into that stack below the fourth story could be transferred to other stacks.

Another objection may be that if the shampoo suds now boil up only for four stories (thus being relieved of pressure) they would, if unrelieved by the fourth story, climb on up to the eighth story!

How about installing a special 10th story holding tank into which the wash water can be diverted for a time long enough to cease foaming, or where some counterfoam liquid or powder can be added?

If this factory knows how to make such potent shampoo that its diluted dregs boil up four stories, the chief chemist of such an organization ought to be able to concoct a neutralizing agent.

There is a classical World War I yarn about unwanted soft soap that was spilled into the harbor of Brest and made so much suds as to obscure a German submarine's periscope and thus save an American transport from being torpedoed!

IMPROVING OPERATION OF BIG HEATING SYSTEM

THERE HAS been further correspondence from the reader who originally brought up the question concerning the heating of the very large industrial plant about which I wrote for my "Page" in the July HPAC. It develops that this plant has 23 independent automatic temperature control systems, each with a program clock for reducing the building temperature overnight and on weekends. The on-off outdoor thermostat for each system opens the main steam supply valve for the respective division or building, but cannot close this valve except after a second thermostat on the end of the steam main has responded to the presence of steam at that point.

In one representative division, a six story building is served, regardless of orientation or variations in heat input from process, by a single outdoor thermostat. It is reported that this building experiences frequent underheating and overheating. It is probable that the amount of heat transmitting surface in each story and on each orientation of this building should be re-apportioned. The indirect heating surface for the large amount of outside air that must be heated and then delivered to replace the air exhausted for various spray booths, shavings conveyors, grinders, etc., requires steam at a positive pressure. These air supply systems tend to freeze when, as at present, the only steam they receive comes through a main at a pressure that fluctuates from perhaps 5 lb to subatmospheric pressure, or when subject to low temperature due to the on-off cycle.

It is reported that the owner paid about $15,000 for this incomplete zone system of steam control and that he is not happy about it. Apparently, he might have been better off today had he stretched the $15,000 as far as practicable in purchasing a thermostat for each department or room, with a valve for each radiator.

It appears that this steam circulating system should be revised so as to serve separately the indirect heating surface that warms the makeup air. Thus, only the relatively small number of steam mains serving these convectors would need be warm enough at all times to protect them against frost, while the direct radiators may work or loaf as required. The general arrangement of piping for steam and condensate is of the two pipe type, with return mains and branches parallel with the steam mains and branches. This would simplify conversion to a vacuum system, since a thermostatic trap easily could be placed at the outlet of each radiator, thus permitting a constant subatmospheric pressure on the return mains.

Complaint is made of the alleged need of introduction of jet water into the suction sides of the old vacuum pumps. These vacuum pumps are obsolete in any case, and modern centrifugal or jet vacuum pumps require no such condenser water if the traps at the radiators are maintained. If I were chief engineer of this plant, I would face the loss of part of the investment in the controls and would commence to correct the basic construction of the heat distribution piping, perhaps including consideration of the possible use of mechanically circulated hot water.

WHAT MAKES THE GHOST WALK?

ONE OF OUR friends has inquired concerning a ghost that walks (or a noise that sounds like it) every time the thermostat starts the hot water circulating pump of his heating plant.

I have a large old house that originally was heated by an excellent gravity circulation hot water system. Several years ago I changed it to employ mechanical water circulation, largely as a research study. The electric pump is controlled by a wall thermostat in the first story at the bottom of the open stairway. The control and the economy are acceptable, except that the old-fashioned supply valves on the radiators have so much clearance that many radiators become as warm with the valve closed as when it is open.

One pleasant room on the second story always has been unpopular with my children because of the walking ghost. In cool weather, whenever the pump goes into action, there is a noise from the expanding pipe that feeds the radiator. I believe the clicking may be chargeable to a careless workman of many decades ago, who, when drilling the floor, left a splinter of wood against the pipe, or who did not allow clearances through the floor for the inevitable movement of the pipe due to expansion.

One becomes accustomed to noises in a house, provided that the sources are explained and that frequency is sufficient to breed contempt.

If I were to convert my own heating system today I would, no doubt, have the pump operate continuously, with the thermostat controlling a mixing valve that would vary the proportions of hot water from the boiler with some recirculated water from the radiators. In such an arrangement there would be no sudden changes in the water temperature at the radiators and there would be less movement of the piping to stir up the ghost.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

The Measurement of Smoke

By K. O. Beatty, Jr.* and James E. Deas, Jr.,† Raleigh, N. C.

SUMMARY—For several years, the Chemical Engineering Department, through the Department of Engineering Research at North Carolina State College, has been interested in certain problems associated with the burning of fuel oils in domestic heating units. This work has necessitated an investigation of a number of methods for measuring smoke. Three of these methods have been adopted for laboratory use as a result of this investigation and specific information has been obtained by the use of these three methods simultaneously over a wide range of operating conditions. The purpose of this paper is to present these results together with the principles involved in these and certain other smoke density procedures. The procedures are of interest to those concerned with other combustion processes as well as fuel oil.

SMOKE emitted from a combustion process may indicate incomplete combustion, a direct economic consideration, and may also produce a community nuisance. This latter aspect has been the subject of a number of papers[1-3]. These problems have stimulated investigators to develop a number of methods for evaluating the extent and nature of smoke. Some of these workers have been concerned with research on combustion processes and others have been interested in control and abatement of atmospheric pollution. All however, have sought some adequate procedure for assigning quantitative values to smoke.

Quantitative measurement of smoke presents a number of virtually insoluble problems. This is apparent from the different characteristics which may make smoke undesirable. Poorly operated furnaces may produce sufficient smoke to create an undesirable atmospheric haze. Deposits of soot in the flues and stack may be of more direct significance to the plant owner. Furthermore, neither the amount of smoke visible nor the soot deposited are measures of the efficiency of combustion of the fuel. A finely dispersed smoke causing appreciable haze may leave no visible deposits anywhere. On the other hand, combustion conditions which rapidly clog the flue and stack with soot may cause only a faint gray stream at the chimney top.

An experimental procedure which measures accurately any one of these characteristics of smoke cannot, of necessity, be expected to give a direct correlation with a procedure which measures some other equally important aspect. There is not, nor can there be, any single solution to the problem of quantitative measurement of smoke. Concrete evidence of the ambiguities resulting from the use of different methods is offered later in this paper.

A brief discussion of some of the various methods now in use, their principles and what they actually measure, seems desirable and is given in the next section. Modifications of three of these methods have been used simultaneously and the data so obtained allow direct comparisons of results of different instruments on the same smoke, thus permitting some interpretation of their relative significance. These results are given in the latter part of this paper.

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[1] Exponent numerals refer to References.

Principal Methods of Measuring Smoke

Smoke indicators may be divided into three groups according to the *ASME* Power Test Code of 1945[3] as follows:

a. Those which are intended for measuring smoke density, according to some scale, either within the stack itself or as it issues from the stack.

b. Those which give a quantitative measure of the degree of smoke pollution in an atmosphere.

c. Those which are primarily operating aids and do not measure smoke density except indirectly.

It is only the first of these groups that is to be considered here, although the methods of the other two groups are basically the same. The methods in common use may be classed as either qualitative or quantitative procedures. The classification is not distinct since without a clear definition of what smoke is, no method can be said to be truly quantitative. However, those procedures which attempt to make measurements under conditions which can be reproduced at the will of the operator, have been called quantitative.

Qualitative Methods

Ringelmann Charts. It is a common but incorrect belief that the amount of soot and flyash in smoke is proportional to its visual density. This is approximately true only when atmospheric conditions, chimney diameter and fuel rate remain constant. Notwithstanding these limitations, the visual density of a smoke has become accepted widely as a legal criterion for maximum allowable smoke.

Probably the first widely used standard of visually measuring smoke was the familiar Ringelmann chart method. The Ringelmann charts are a series of cards, ruled as shown in Fig. 1, so that at a distance they appear as shades of gray. The density of these charts covers the range of solid white to solid black through four intermediate shades of gray. These charts are visually compared with the effluent smoke to give values from 0 for no smoke to 5 for dense black smoke. The chart (in the form of a card having 200 or 300 squares of the type shown) is set in a direct line between the chimney and the observer at a distance of about 50 ft from the observer. The observer then makes visual comparison of the smoke directly across the top of the stack with the apparent shades of the Ringelmann cards as observed at a distance of 50 ft.

This method has gained widespread use since it involves inexpensive equipment and evaluates apparent density of the effluent smoke, which is the feature most likely to be criticized by the public. It is desired in most cases to keep the apparent density of the smoke entering the air to a minimum and therefore, city smoke ordinances have generally specified a certain Ringelmann number as the maximum density allowable.

There are certain disadvantages, however, in this visual smoke density evaluation[4].

1. The apparent density of the smoke depends on the amount of light coming through the smoke to the observer, and hence, it depends on the nature of the background.
2. It is influenced by the wind velocity. When the wind is blowing strongly, the smoke is scattered widely and appears very thin; however, when the air is still, the smoke accumulates, giving a more dense appearance.
3. High relative humidity tends to intensify the apparent density of any smoke dispersion.
4. The size of the chimney from which the smoke issues causes a marked change in the apparent density of a smoke. The larger the chimney, the denser the appearance of the smoke if other factors are constant.
5. The smoke inspector has a problem of judging the comparative density of two widely spaced surfaces, *i.e.,* the charts and the smoke.

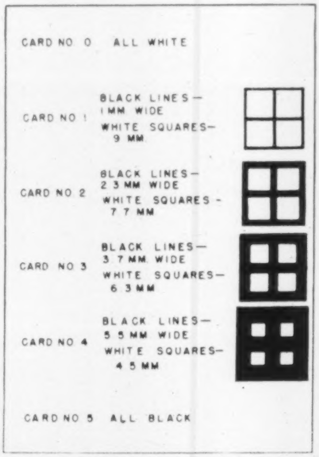


Fig. 1—Specifications for ruling of Ringelmann charts

With compensations for these objections, the Ringelmann method may be satisfactory for municipal ordinance control, but it is of little value for purposes of quantitative comparison.

Umbrascope. The umbrascope was developed to overcome some of the more obvious limitations of the Ringelmann charts. In its use a small sighting tube is arranged so that half of the field of vision may be covered by semicircular plates of clouded glass. The degree of darkness can be regulated by inserting up to four glasses in series. A direct comparison can then be made between the clouded glasses and the smoke as viewed through the open half of the field of vision.

Details of both of these methods together with variations of them are given in the *ASME* Power Test Code[3].

Quantitative Methods

Filter Spot. Particles of smoke dispersed in a gas can be collected by means of an appropriate filter medium. If a fixed volume of flue gas is drawn through a filter, such as white filter paper, the density of the spot produced by the deposited smoke particles can be used as a measure of smoke density in the stack. The spot thus obtained is usually compared with various standard spots ranging from white for no smoke to black for dense smoke. In one system, a number is assigned to each standard spot, ranging from 0 to 9 by units of ½ (19 standard spots total). For combustion processes which produce black smoke spots such as those burning coal or petroleum products.

this method of smoke measurement has been used with considerable success. However, the apparent intensity of the spot is a function of color as well as quantity of smoke deposited. White smoke particles would fail to show up on the filter, and intermediate color shades would show up to a lesser degree than would the same quantity of black smoke particles. Particle size also affects the results obtained with this method of smoke measurement. Very fine particles may be only partially collected on the filter and the shade of the spot obtained may be different from that for an equal weight of larger particles.

In recent years several smoke meters have been designed to make use of this principle of collecting smoke particles on a filter. The North Carolina State College, Department of Engineering Research, has fabricated an apparatus designated the *NCS* smoke meter which employs this principle. It is discussed in detail in the section *NCS Smoke Method*.

Although visual comparison between the spot and a special scale is common, alternative procedures such as photoelectric devices and weighing have been used.

Deposit Methods. It is a well established fact that smoke particles tend to deposit on surfaces in contact with the smoke, particularly if these surfaces are cooler than the smoke. The rate of deposition on a surface can be used as a measure of smoke density in a flue or stack under certain conditions.

One method for determining the rate of deposition is to allow smoke to settle on a clear glass rod for a given length of time. The density of the deposited smoke particles is then measured by means of a photoelectric meter calibrated to indicate the percent of light transmitted, based on 100 percent transmission for a clean glass rod. The *Institute of Cooking and Heating Appliance Manufacturers* has developed such a meter, and it is described in a later section under the heading *ICHAM Method*.

Another method which might be used for determining the rate of deposition of smoke particles on a surface suspended in a smoke stream is a sensitive weighing device. A Jolly balance may be used to weigh a screen or other suitable surface suspended in the gas stream through a small hole in the stack. The rate of increase in weight of the suspended surface due to smoke deposition will be a function of the density of the smoke. This method has not, to the knowledge of the writers, been used for measuring smoke density although the principle has been used in testing anti-sooting agents.

Light (Radiant Energy) Transmission Methods. A characteristic of smoke which lends itself readily to quantitative measurement is its obscuring effect on light. When a beam is directed through a gaseous dispersion of smoke particles, some of the light is absorbed by the particles, some is scattered at various angles, and some passes through undeflected. If a means is provided for measuring the light transmitted through the smoke, the decrease in light intensity from that obtained without smoke is a measure of the smoke density.

The light transmitted through a dispersion such as smoke is a complex function of particle size, concentration and nature. A very minute amount of material appropriately dispersed may produce a highly opaque smoke whereas a relatively large amount suspended as coarse particles may give high transmission factors. The method is thus a measure of the ability of the smoke to obscure light and not necessarily a measure of the density of the smoke as it would appear to an observer. To an observer, the appearance of smoke is a function of color and background. Smoke viewed by a combination of reflected and transmitted light may appear to have a different density than the same smoke viewed entirely by transmitted light.

One device for measuring light intensity is a photoelectric cell. In practice, a constant intensity light source is mounted so that a light beam, directed through a section of the smoke pipe, strikes the photoelectric cell. Usually for a large industrial stack, the beam is directed transverse to the flow of gas. In smaller stacks the beam may be directed longitudinally through an offset section of the pipe through which the entire products of combustion must pass. The light received by the photoelectric cell is measured by the output of the cell as read on a microammeter calibrated directly in microamperes or in arbitrary smoke units.

A *photoelectric* smoke meter similar to one developed by Underwriters' Laboratories, Inc. with certain modifications has been successfully employed in the laboratories of the Department of Engineering Research for making smoke measurements. This instrument is described more fully in a later section under the heading *Photoelectric Smoke Meter*.

Another transmission method of measuring smoke density is based on the bolometric principle of measuring minute quantities of radiant energy. A source of radiant energy, usually an incandescent light, is mounted at one side of the smoke stream and the radiant energy transmitted is collected at the other side. The bolometer differs from the photoelectric cell in that it measures total radiation rather than light intensity alone. Since the majority of energy particles emitted by an incandescent light is in the infra-red region, the amount of absorption observed may be different from that observed with a photoelectric cell. A smoke density recorder, making use of the bolometric principle, has recently been placed on the market.

The advantages of the radiant energy transmission methods of measuring smoke density may be summarized as follows:

1. They give a continuous check on smoke density and are easily adapted to recording instruments.
2. When adjusted and maintained properly, they give a high accuracy and sensitivity to changes in smoking rates.
3. They can be equipped to alert an operator when the maximum allowable smoke density has been reached, so that steps can quickly be taken to correct the condition.

A disadvantage common to both the photoelectric and bolometric methods is the tendency of soot and dust to deposit on the light source and the collecting cell windows. The *photoelectric* method has the further disadvantage that the output of the cell tends to decrease upon prolonged exposure to light.

Electrical Precipitation. When smoke particles, fumes or liquid droplets, entrained in a gas, are given a high negative electrical charge, they will adhere to a positively charged plate. By using a suitable means of collecting these adhered particles, the entrained solid and liquid particles can be effectively removed from effluent gas streams.

The electrical precipitator makes use of this principle for a wide range of dust removing purposes. The precipitator in its simplest form consists of a wire suspended in a pipe through which the gas flows. A high tension direct current passes from the wire through the gas (negatively charging the particles present) to the pipe which serves as the positively charged collector plate. The particles rapidly move toward the positively charged surface and adhere; however, if too many of these adhered particles accumulate, some of this material may flake off and become again entrained in the gas and thus be carried to the atmosphere. Therefore, the usual practice is to provide for intermittent removal of the deposit from the positive plate.

The primary source of current generally used is 110 to 550 volts a-c power stepped up by means of a transformer to a range of 15,000 to 25,000 volts for small scale laboratory work and 50,000 to 75,000 volts for industrial size units. The current is then rectified to unidirectional, high potential current, suitable for precipitation. A diagram of the essential elements of an electrical precipitator is given in Fig. 2. In laboratory devices, aluminum foil may be used to line the pipe so that the charged particles collect on the aluminum foil from which they can later be removed.

Portable electrostatic samplers are available and in wide use for smoke and dust contamination work of all sorts. One of their principal advantages is the high percentage of recovery of even extremely minute particles. The material recovered is in a form well suited for further examination as to its physical and chemical nature. To the knowledge of the authors, this principle has not been employed in the routine measurement of smoke resulting from the combustion of fuels.

Counting of Particles. Smoke particles generally range in size from 0.2 to 1.5 microns (1 micron = $\frac{1}{1000}$ millimeter). A knowledge of the number of particles in a given volume of gas together with the average particle diameter constitutes a good measure of the density of a smoke. The most widely used research tool for making smoke counts is the ultramicroscope because the particles are frequently below the range of the ordinary microscope. The apparatus consists of a suitably lighted sampling chamber and an ultramicroscope fitted with a slit or eyepiece aperture which restricts the vision to a known area. From the depth of focus, the area of the aperture used and the particle count, the number of smoke particles per unit volume can be calculated. For operation, a sample of smoke is drawn into the sampling cell and a number of successive counts are made. As many as fifty counts may be necessary in order to have a reliable coverage.

A method for collecting the smoke particles so that a count may be taken at leisure has been proposed by R. Whytlaw-Gray, W. Cawood and H. S. Patterson[10]. By this method a sample of the smoke is trapped in a small space of known volume between two glass plates in a special holder. The smoke particles are allowed to settle out on the lower glass plate which is then removed and placed under an ultramicroscope where the particles may be counted.

Particle size measurements present an appreciable problem because their range is frequently below that permitting direct or photographic microscopic examination. In many studies, the particle diameters are merely estimated and particle count is used as the basis of comparison between smokes.

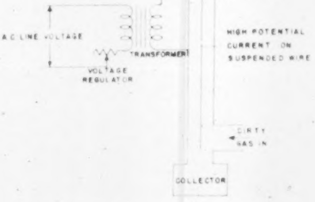


Fig. 2—Diagram of electrical precipitator

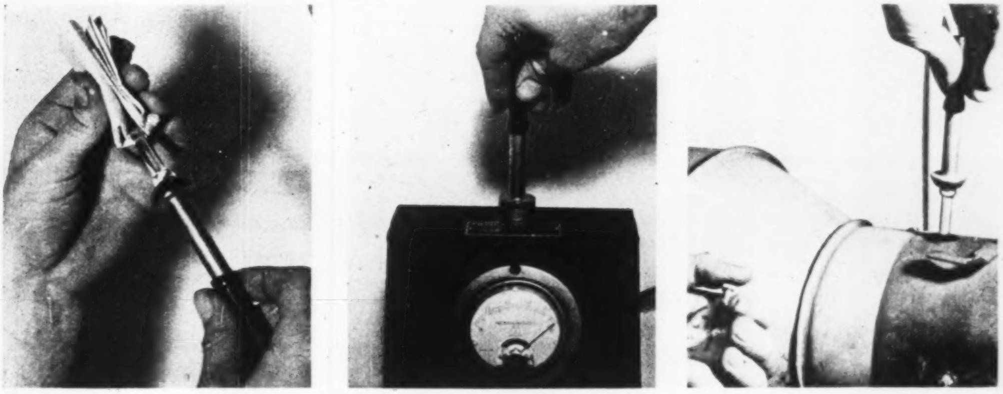
Methods used at North Carolina State College

Since it was felt that no one method of measuring smoke would give complete information, three methods were chosen for investigation, each being based on a different principle. They are described in some detail in the following pages and a comparison is given of results obtained with all three methods under a variety of combustion conditions.

ICHAM Method. This method receives its name from the initials of its sponsor, the *Institute of Cooking and Heating Appliance Manufacturers.* Since it is a deposit method, it would be expected to serve as a good measure of the tendency of the smoke to clog flues and chimneys.

In the *ICHAM* method, a specially designed clean pyrex glass rod about $^{5}/_{16}$ in. in diameter by four in. in length is inserted into a horizontal portion of the flue through a small hole in the top. The rod is thus in a vertical position, normal to the flow of smoke. The rod is exposed to the smoke for a total of 20 min. For the purpose of obtaining a uniform deposit, the rod is rotated 180 deg about its longitudinal axis when half of the exposure time has elapsed.

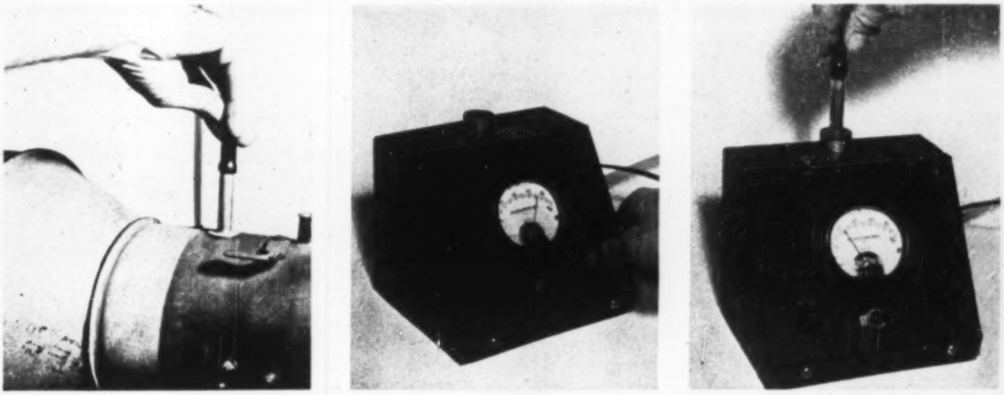
The rod is removed from the stack at the end of the 20 min and the extent of deposit is determined by measuring the light which will pass through the coated rod on a diameter. This is done by inserting the rod in an instrument contain-



Step 1: Clean smoke rod thoroughly.

Step 2: Insert clean rod in meter and rotate to point of lowest reading. Adjust meter to read 100 transmission. Remove rod and note the meter reading on air.

Step 3: Insert rod in stack opening and start timing simultaneously.



Step 4: Rotate smoke rod 180 deg in stack when exactly half the exposure time has elapsed.

Step 5: Adjust meter to read the same light transmission through air as observed in Step 2.

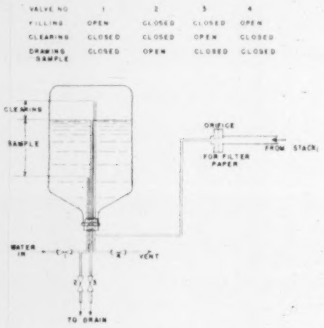
Step 6: Insert exposed smoke rod in meter and rotate. Lowest observed reading is the *ICHAM* smoke.

Fig. 3—Steps in obtaining *ICHAM* smoke values

ing a light source, photocell and milliammeter, housed in a metal cabinet.

The instrument is provided with a support for the glass rod and an arrangement for directing a beam of light through the rod onto the photocell. The cell is connected to a meter containing a scale graduated from 0 to 100. The voltage to the light source is maintained constant by means of a constant voltage transformer. The light meter must be set at the beginning of each test run by adjusting the light intensity so that the meter indicates 100 with the clean glass rod inserted in it. In order to reproduce this setting when ready to make measurements on the coated rod and before the rod is inserted, the meter is set to the same value of light transmission as was noted immediately after the clean rod had been removed when the meter was adjusted for 100.

When the meter has been properly adjusted, the coated rod is inserted and rotated slowly. Because of variations in the deposit and in the rod, fluctuations of meter reading of several percent will be noted. The lowest value observed is taken as the reading. Since similar fluctuations are observed when rotating a clean rod, the initial setting is made at 100 with the clean rod in the position of lowest light transmission.



VALVE NO	1	2	3	4
FILLING	OPEN	CLOSED	CLOSED	OPEN
CLEARING	CLOSED	CLOSED	OPEN	CLOSED
DRAWING SAMPLE	CLOSED	OPEN	CLOSED	CLOSED

Fig. 4—Diagram of NCS smoke apparatus with operating position of valves. As shown, the water level in the bottle is in position to start drawing a smoke sample across a clean filter disc

The various steps in the procedure are shown in the series of photographs in Fig. 3.

Since the readings are based on light transmitted, the amount of deposit or smoke is proportional to 100 minus the *ICHAM* reading. Values of *ICHAM* smoke are usually reported as meter readings and hence increase with decreasing smoke.

NCS Smoke Method. The *NCS* meter is the name given to a modification of the filter spot method developed at North Carolina State College. In this apparatus a fixed volume of smoke is drawn through white filter paper and the intensity of the spot produced is compared visually with a series of standard spots. The procedure is essentially a measure of the total amount of dispersed solids in the smoke.

A schematic diagram of the apparatus is given in Fig. 4. This shows the valve arrangements for the three steps in sampling. The water flowing from the 18 liter bottle draws the sample of smoke from the stack through the filter paper into the bottle. The volume of the sample is regulated automatically by the relative positions of the two overflow pipes. As currently operated, a sample of 8200 cc is drawn through the filter paper in approximately 160 sec.

The filter paper is held between two carefully finished brass fittings. A gasket, cut with an inner hole the size of the hole in the brass fittings, is used to prevent leakage of air into the system. The diameter of the spot is about $^{15}/_{16}$ in. The filter paper used is Whatman No. 4.

Typical spot samples are shown in Fig. 5 for several ranges of smoke. In this photograph, two spots have been made on each filter paper to show the general reproducibility of results. The penciled numbers by each spot correspond to the rating obtained by comparison with the scale of standard spots. The scale

Table 1—Comparison of Effect of Excess Air on Values of *ICHAM*, *NCS*, and *Photoelectric* Smoke Readings

(All data obtained burning light fuel oil in a forced draft pot-type burner)

Excess Air	%	27.5	23.1	17.8	16.5
Fuel Rate	lb/hr	4.76	4.84	4.88	4.90
ICHAM Smoke Reading		78	73	52	32
NCS Smoke (Shell Co. Units)		2.0	2.5	4.0	5.0
Photoelectric Smoke (milli-amp drop)		0.3	0.6	0.8	1.8
Stack Temperature	Fahr.	782	780	765	767
Room Temperature	Fahr.	76	77	78	82

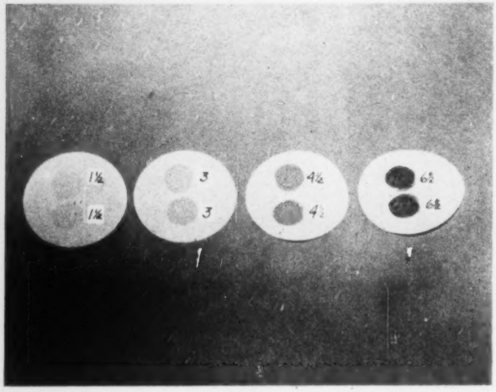
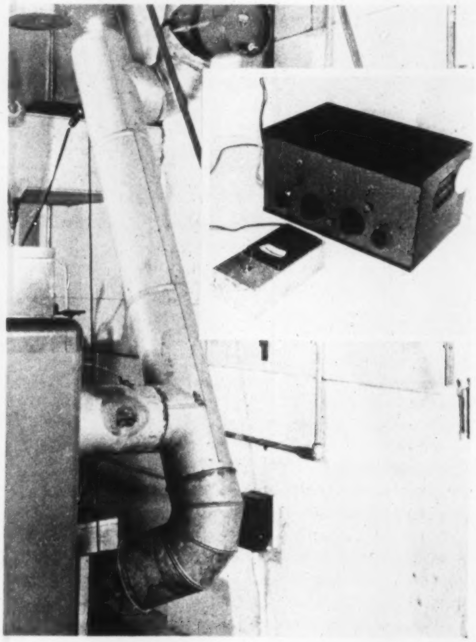


Fig. 5—Photograph of smoke spots obtained using the NCS smoke meter

The smoke spot values shown are from left to right 1½, 3, 4½ and 6½ on the Shell Oil Co. scale. The two spots on each filter disc show the reproducibility of results by this method

Fig. 6—*Photoelectric* smoke installation at North Carolina State College

Photograph of offset stack section with lamp assembly mounted at top left, and *photoelectric* cell mounted at end of elbow, lower left. Insert shows control cabinet for operating two photoelectric installations; microammeter is in lower left of insert



used for comparing smoke spots on the filter paper is one developed by The Shell Oil Co. for use with its Shell Smoke Meter, which operates on the same principle. This scale consists of 19 standard spots ranging in density from solid white to solid black. The scale begins numerically at 0 for white and goes to 9 for black by units of one half, thus giving increasing numerical values for increasing smoke densities.

Photoelectric Smoke Method. The light transmission method was adapted to measure smoke photoelectrically in the Engineering Research Laboratory. As mentioned in the previous discussion, the method is not a direct measure of either quantity of suspended material or its nature. It, therefore, differs distinctly from both the *ICHAM* and *NCS* methods.

The arrangement used in this investigation is shown in the photographs of Fig. 6. A diagram of the apparatus is given in Fig. 7. To obtain an appropriate length of path, the flue gas is passed through an offset section of the stack four feet long. A 100 watt projection lamp is mounted at one end of this section of pipe. The output of a constant voltage transformer supplies the current for this lamp through a variable transformer in parallel and a rheostat in series with the lamp. Light from the lamp source enters the flue gas along the axis of the stack through a two-inch diameter hole in a cap over the end of the pipe.

An elbow is mounted at the opposite end of this section of stack with a prism set at the center of the bend in such a way that light from the projection lamp is deflected onto a *photoelectric* cell. The photoelectric cell is mounted at the end of the elbow rather than at the end of the four foot section of pipe in order to remove it from the effects of heat from the stack gases.

The output of the *photoelectric* cell is indicated by means of a microammeter. Before starting a test with the furnace, the light intensity from the lamp is adjusted so that some predetermined and convenient value is obtained on the microammeter. It is best to make this initial setting on a preheated stack. Care must be taken to assure that no products of combustion are present when this setting is made.

Readings taken while smoke is being produced will be less than the initial setting since the smoke interferes with passage of the beam of light, and the output of the *photoelectric* cell will be accordingly less. Thus, the difference between the initial microammeter reading and the test reading or microampere drop is a measure of the quantity or density of the smoke passing through the smoke section.

Smoke readings are reported in terms of this microampere drop and hence, increase in value with increasing smoke densities.

Comparison of Smoke Methods

The extensive tests being carried out on the effect of combustion conditions on the burning of fuel oils afforded an opportunity for comparing the results obtained with the three smoke meters under a variety of conditions. In the standard tests being run the fuel rate and the air rate were varied for several types of domestic heating units when burning a number of different fuel oils. The data presented here, however, are limited to a single type of furnace using a forced draft, pot type unit.

An increase of the amount of excess air used in combustion usually reduces the amount of smoke produced. The data in Table 1 show the effect of excess air on the smoke values obtained by each of the three methods when the fuel rate is held constant. It will be noted that although the *photoelectric* smoke value increased six fold when the percent excess air was reduced from 27.5 to 16.5, the *NCS* smoke only increased two and one half times. Comparison of these three methods indicates that although all show increasing smoke with decreasing excess air, the relationship among the three is by no means linear.

There are several reasons for this. In the first place each of the scales is arbitrary and can not be said to be a linear measure of smoke density. Consequently the relationship

Table 2—Summary of Smoke Data from Three Meters

(All data obtained in tests of a forced-draft pot-type burner)

Fuel Rate Lb/Hr	Smoke Meter Reading			
	ICHAM	(100 − *ICHAM*)	*NCS*	Photoelectric
	Group A—High Fuel Rates			
4.46	95	5	0.5	0.2
4.44	82	18	2.2	0.6
4.45	16	84	6.2	2.6
4.54	36	64	4.3	1.5
4.56	83	17	2.2	0.5
4.58	50	50	4.0	1.2
4.39	73	27	—	0.9
4.52	50	50	—	1.6
4.67	63	37	—	1.3
4.60	11	89	—	3.4
4.63	48	52	—	1.4
4.65	25	75	—	2.3
4.65	91	9	2.2	0.4
4.70	66	34	4.0	1.2
4.71	19	81	6.2	3.8
4.84	73	27	2.5	0.6
4.76	78	22	2.0	0.3
4.88	52	48	4.0	0.8
4.90	32	68	5.0	1.8
4.42	91	9	1.2	0.2
4.50	71	29	3.0	0.8
4.50	27	73	5.0	2.2
4.15	94	6	1.2	0.4
4.24	51	49	4.3	1.6
4.17	57	43	4.3	1.1
4.23	39	61	5.1	2.0
	Group B—Intermediate Fuel Rates			
4.14	40	60	4.7	1.7
4.13	65	35	4.3	1.0
4.12	80	20	3.7	0.4
4.17	73	27	—	0.8
4.10	56	44	—	1.7
4.06	37	63	—	2.2
4.12	86	14	1.7	0.4
4.03	64	36	3.7	1.2
4.02	35	65	5.5	2.3
3.94	79	21	2.7	0.2
3.96	64	36	3.7	0.8
4.06	41	59	5.0	1.5
3.84	68	32	—	1.2
3.80	18	82	—	3.7
3.93	66	34	—	1.0
3.94	22	78	—	2.8
	Group C—Low Fuel Rates			
3.67	55	45	—	1.5
3.70	42	58	—	2.2
3.64	25	75	—	3.0
3.48	51	49	4.5	1.7
3.48	81	19	3.0	1.0
3.52	94	6	1.5	0.6
3.36	90	10	2.0	0.6
3.22	48	52	5.0	2.9
3.27	21	79	7.5	5.5
3.24	95	5	1.3	0.2
3.14	81	19	3.1	0.7
3.29	32	68	6.0	2.8
2.97	69	31	—	1.7
3.00	37	63	—	3.3
2.84	44	56	—	2.3
2.93	18	82	—	4.9

between them will not be linear. This, however, would not preclude a direct correlation between any two sets of values.

The second and more important reason for the lack of agreement between methods is that other characteristics of the smoke change along with its density. Reducing the amount of excess air alters the nature (size, shape and composition) of the smoke particles as well as their concentration.

This change in the nature of the smoke particles is even more pronounced with variations in the fuel burning rate of the burner. To illustrate this, data are given in Table 2, representing average results for a number of runs at various fuel rates. The data are listed in order of decreasing fuel rate and have been arbitrarily grouped as high, intermediate and low fuel rates.

Comparisons of results are presented graphically in Figs. 8, 9, 10 and 11. In Fig. 8 the relationship between *ICHAM* smoke and *photoelectric* smoke values is given. To avoid the natural inverse relationship, values of 100 minus *ICHAM* readings have been used. It will be observed that there is considerable spread of the data and this is particularly pronounced at high smoke density values on the *ICHAM* scale. This indicates that some smokes having high deposit forming tendencies are much more transparent than others.

Only the data of Groups A and B are plotted in Fig. 9. Here the data do fall fairly distinctly into the same groups on the graph. For the forced draft, pot type burner, it appears that at low fuel rates, the smoke is less transparent for a given amount of deposit than at high fuel rates. This possibly indicates a higher degree of dispersion or a lower average particle size at the low fuel rates. Another explanation is that at high fuel rates, the particles are more adhesive and less carbonized, and hence have a greater tendency to deposit than particles produced at low fuel rates. Actually it seems probable that both

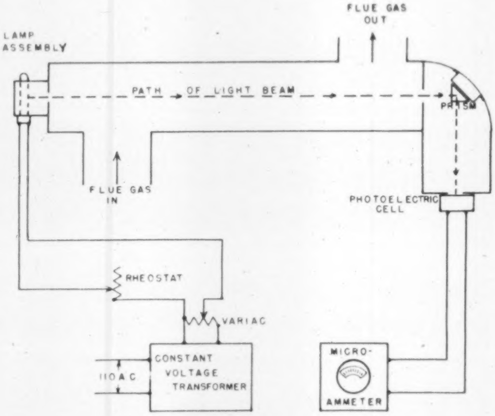


Fig. 7—Diagram of *photoelectric* smoke apparatus with essential parts as installed at North Carolina State College

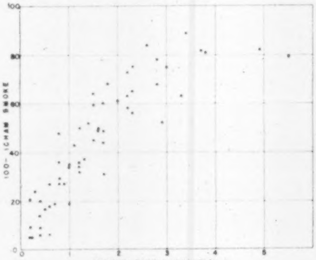


Fig. 8—Summary of data showing relation of *ICHAM* to *photoelectric* smoke indication

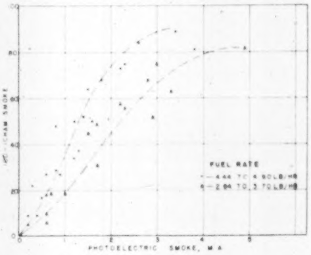


Fig. 9—Effect of change in fuel rate on relation between *ICHAM* and *photoelectric* smoke indication

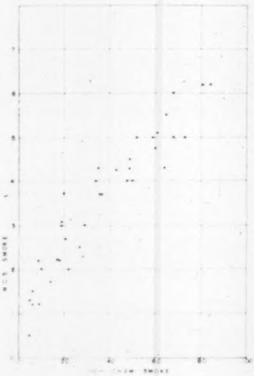


Fig. 10—Summary of data showing relation of *NCS* to *ICHAM* smoke indication

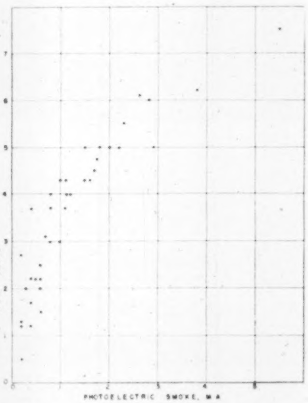


Fig. 11—Summary of data showing relation of *NCS* to *photoelectric* smoke indication

factors are operating simultaneously. The changes in the stack temperature with changes in the fuel rate, as indicative of variations in combustion conditions, substantiate this idea.

The important point to be drawn from Fig. 9 is that no reliable indication of the soot depositing tendency of a smoke may be drawn from the *photoelectric* reading. A wide variation in fuel rate at a given *photoelectric* smoke reading may have as much effect on *ICHAM* smoke as does a wide variation in *photoelectric* smoke at a constant fuel rate.

The comparison of *NCS* smoke values with *ICHAM* smoke is shown in Fig. 10. The agreement here is much better and more nearly linear than the previous values. It will be observed, however, that an average line drawn through the plotted points will intercept the *NCS* scale at one instead of zero. The *NCS* filter spot tends to give visible readings even though the smoke particles have little tendency to deposit as shown by the *ICHAM* test. It seems probable that a shift in this relative sensitivity at low smoke values could be made by altering the time of exposure for the *ICHAM* test or the size of the sample drawn in the *NCS* test. If this were done, the two methods might be brought into sufficiently good agreement to establish a correlation or rough conversion factor between them. It should be remembered that all of these values were taken with smoke from a forced draft, pot type oil burner. Entirely different relationships might be obtained with coal- or wood-fire smoke or with other types of furnaces.

The relation between *photoelectric* smoke and *NCS* smoke values is shown in Fig. 11. The data fall on a more or less parabolic curve with the most severe scattering being noticed at the low smoke values. It will be observed that smokes giving quite distinct *NCS* spots as high as four may show very low *photoelectric* smoke values. A few relatively large particles filtered out will give a heavy spot test, but since light is scattered more by numbers than size, the transmission will still be high.

Discussion and Conclusions

Each of the graphs just presented shows that several smoke samples, each of the same value by one method, may have a variety of values when measured by some other procedure. Conversely, smoke samples which appear distinctly different when measured by one procedure, say the *NCS* method, may be indistinguishable by a procedure such as the *photoelectric*.

It is, therefore, impossible to say that one method is better than the other. It can only be said that they are different. If no correlation exists when all measurements are made on fuel oil burned in a single furnace it is obvious that agreement could not possibly be expected with a variety of furnaces or different fuels.

The conclusion must be drawn that each method measures different aspects of smoke and not smoke itself. The simultaneous use of several methods gives more complete information than any one alone can give. Use of several methods should aid in prediction of the effect of combustion conditions on the performance of fuels.

Acknowledgment

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100 FOREIGN NATIONS READ AMERICAN STORY

The story of what goes on in American industry, as told in house organs published for American workers and management, is now being read in upwards of 100 countries throughout the world. In a preliminary survey by the Philadelphia Industrial Editors Association it was found that one company in the Philadelphia area is mailing its employee-employer publication to 5000 persons in 78 countries. This relatively obscure arm of American journalism is helping to bring the truths of American working and living conditions to people of other lands, in the opinion of George W. Talmage, chairman of the 1951 convention of the *American Association of Industrial Editors*.

House organs are now going to an increasing number of persons in foreign countries and include those published for banks, chain and department stores, insurance and public utility organizations and large and small industrial corporations, according to Mr. Talmage.

The preliminary survey, listing the countries to which house organs are being mailed, included all those in western Europe, southern Asia, North and South America, North Africa and the Union of South Africa, the British Empire, Ireland, Atlantic and Pacific island countries, and even China. All branches of the U.S. military services are included in the mailings.

JOURNAL SECTION

Use of Aircraft Propellers for Axial Flow Fans

By Elmer C. Lundquist*, Iowa City, Ia., and M. J. Hamilton†, Santa Monica, Calif.

AIRCRAFT propellers are frequently installed in ducts to be used as axial flow fans for moving large quantities of air against low pressures. The usual propeller performance curves are obtained from propeller tests in an unconfined air stream and are not suitable for predicting the performance of a propeller when acting as an axial flow fan. This paper will present results obtained from model tests on the performance of aircraft propellers used as axial flow fans with particular emphasis on the method of using these results to predict the performance of prototype fans of geometrically similar shape.

Data for two-, three-, and four-bladed propeller fans obtained from scale model tests will be presented in dimensionless form. Equations employing consistent units will be developed using the principle of dimensional analysis. Since equations in this form, however, are not commonly employed by the heating and ventilating engineer, the equations will be converted to a form incorporating conventional units. It will then be shown how the equations and data herein presented may be used to select a propeller fan of appropriate size and speed for any specified requirement of pressure rise and air capacity. It will also be shown how the performance of fans of any size geometrically similar to those tested may be predicted for any set of operating conditions.

SUMMARY—Scale models of aircraft propellers having two, three and four blades were installed in ducts and tested for performance as axial flow fans. Data obtained and presented in dimensionless form, and equations developed, are useful in selecting fans for a required performance. Performance of a fan of any size may be predicted by the method given if information is available for any geometrically similar fan.

Analysis of Problem

A preliminary dimensional analysis of the variables involved in the problem of determining the performance of aircraft propellers, when used as axial flow fans, provides useful information relative to the grouping of variables. It will be assumed that it is desired to determine the pressure rise produced by the propeller and the power required to turn the propeller as functions of the other variables involved. The variables that appear to be of importance in this problem are:

p = pressure rise across the propeller disk, pounds per square foot.

P = shaft power supplied to the propeller, foot pounds per second.

V = average axial velocity of flow through the propeller disk, feet per second.

n = rotating speed of propeller shaft, revolutions per second.

D = diameter of propeller, feet.

ρ = mass density of medium flowing through the fan, slugs per cubic foot.

μ = absolute viscosity of medium flowing through the fan, slugs per foot second.

a = velocity of sound in the medium flowing through the fan, feet per second.

β = blade angle of the propeller blade at a designated radius (in this case taken at a radius of 75 percent of the tip radius), degrees (dimensionless).

The shaft power required for the propeller fan can be expressed symbolically as

$$P = f_1\,(V, n, D, \rho, \mu, a, \beta) \quad \ldots\ldots (1)$$

According to a theorem commonly employed in dimensional analysis a function such as the one expressed by Equation 1 can be reduced to a function involving a number of dimensionless terms equal to the number of variables involved minus the number of fundamental dimensions. All the quantities in Equation 1 may be expressed in terms of the three fundamental dimensions of mass, length, and time. Hence, the number of dimensionless terms necessary to express the relation between the variables will be 8 — 3 = 5. Employing the procedures used in the theory of dimensional analysis, the following grouping of variables is obtained.

$$\frac{P}{\rho n^3 D^5} = f_2\left[\frac{V}{nD}, \frac{\rho n D^2}{\mu}, \frac{nD}{a}, \beta\right] \quad \ldots\ldots (2)$$

In a similar fashion, the pressure rise across the fan disk may be written as

$$p = f_3\,(V, n, D, \rho, \mu, a, \beta) \quad \ldots\ldots (3)$$

which in turn can be reduced to

$$\frac{p}{\rho n^2 D^2} = f_4\left[\frac{V}{nD}, \frac{\rho n D^2}{\mu}, \frac{nD}{a}, \beta\right] \quad \ldots\ldots (4)$$

Both Equations 2 and 4 involve five dimensionless terms, one of which is expressed as a function of the other four, and they imply that the value of the dependent variable is determined by fixing the values of the four independent variables. Furthermore, the value of the dependent variable is not affected by a regrouping of values of the terms making up the independent variables so long as the numerical values of the groups comprising the independent variables are unchanged.

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†Air Conditioning Design Engineer, Douglas Aircraft Co.

As an example, suppose $V = 50$ fps, $D = 5$ ft and $n = 10$ rps. Then $V/nD = 1.0$. The value of $p/\rho n^2D^2$ obtained experimentally for these conditions could be expected to be the same as for a fan geometrically similar in all respects where $V = 30$ fps, $D = 3$ ft, $n = 10$ rps and $V/nD = 1.0$ provided, of course, that in both cases the values of $\rho nD^2/\mu$, nD/a, and β were identical.

Equations 2 and 4 both contain four independent variables. The experimental work which would be required to express either of these functions, by varying only one parameter at a time, would therefore be quite tedious. Fortunately it can be shown that two of these four variables contribute very little to the value of the function and can, in general, be neglected. These two variables are $\rho nD^2/\mu$ and nD/a.

The term $\rho nD^2/\mu$ is essentially the Reynolds number of flow around the propeller. The product of nD is proportional to the tip speed of the propeller, V_t and hence $\rho nD^2/\mu \cong \rho V_tD/\mu$. This latter term may be recognized as the familiar Reynolds number. Experience with the effect of Reynolds number for flow around airfoils indicates that the value of the coefficients of lift and drag are influenced only to a small extent by a change in Reynolds number. In general, the maximum value (the stalling value) of lift coefficient is increased as Reynolds number is increased but for low angles of attack the lift coefficient is independent of Reynolds number. Also, only the minimum value of drag coefficient is influenced by a change in Reynolds number. Since the blade elements of a propeller type fan are not operating at either the stalling or the minimum drag condition when the fan is operating near peak efficiency, and since the pressure rise and the shaft power required are both related to the lift and drag coefficients of the propeller elements, it can be concluded that the Reynolds number in this case represents a variable of small importance.

The term nD/a appearing in Equations 2 and 4 is the Mach number. Since $nD \cong V_t$, the tip velocity, the term nD/a is proportional to V_t/a which is the ratio of the tip speed of the propeller to the speed of sound. This is a variable that is unimportant in this analysis unless it attains a value in excess of from 0.7 to 0.8. For values of Mach number in excess of this, compressibility effects cannot be neglected. For lower values, however, the influence of a variation in Mach number has practically no bearing on the fan performance.

Eliminating the Reynolds number and the Mach number from Equations 2 and 4 results in

$$\frac{P}{\rho n^3D^5} = f_5\left[\frac{V}{nD}, \beta\right] = C_q \qquad \text{(5)}$$

$$\frac{p}{\rho n^2D^2} = f_6\left[\frac{V}{nD}, \beta\right] = C_p \qquad \text{(6)}$$

where

C_q = a power coefficient.

C_p = a pressure coefficient.

Both are dimensionless and are functions of the dimensionless quantities V/nD and β.

The basic equations preparatory to experimental work have now been presented. The performance of the fan can be completely determined by obtaining the variation of C_q and C_p with V/nD, known as the advance-diameter ratio, for various constant values of β, the propeller blade angle. Results obtained from model experiments are applicable to larger geometrically similar prototypes operating at the same value of V/nD and β. It should be remembered, however, that this conclusion presumes dissimilarity in Reynolds number and Mach number to be of negligible importance.

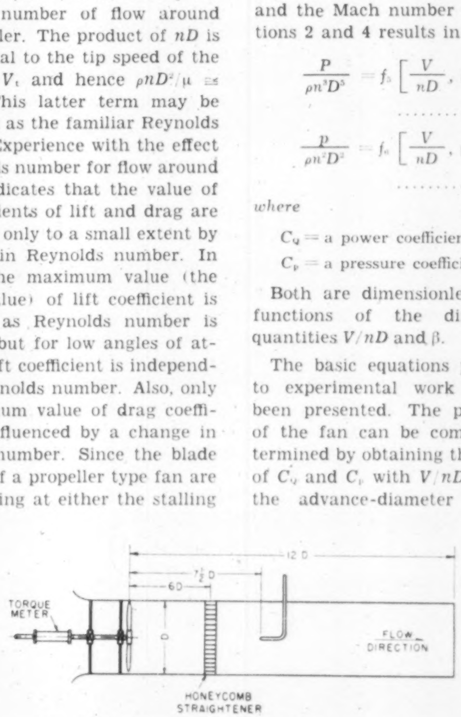

Fig. 1—Schematic diagram of test equipment

Experimental Apparatus

A schematic diagram of the test apparatus is shown in Fig. 1. A model airplane propeller 24¾ in. in diameter was mounted on a drive shaft in a duct 25 in. in diameter as shown. The propeller shaft was supported in bearings suspended by three radial rods or spokes anchored to the periphery of the fan casing. Tests were made on propellers having two, three, and four blades. In all cases, the propeller hub was not faired nor were stationary guide vanes installed.

A honeycomb straightener was installed in the duct six diameters downstream from the propeller. Pitot tube traverses, both horizontal and vertical, were made at a point 7½ diameters downstream from the propeller. The average static pressure obtained at the traversing station was corrected to obtain the static pressure at the fan outlet by the methods recommended by the standard fan test code.[1]

The power input to the propeller fan was obtained by measuring the shaft speed and the shaft torque with the torque meter indicated in Fig 1. This torque meter included a long, slender torque rod enclosed in a double barrelled casing. The outer cylindrical casing was mounted concentrically with the inner casing on ball bearings. The two casings were then restrained from rotating with respect to one another by the long torque rod. The application of torque would cause an angular deflection of the one casing with respect to the other, the torque being absorbed by the torque rod. When the fan was in operation the angu-

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[1] Standard Test Code for Centrifugal and Axial Fans (ASHVE and the *National Association of Fan Manufacturers, NAFM Bulletin* No. 103).

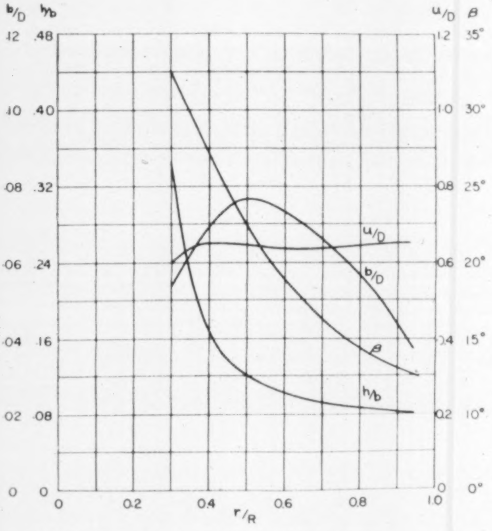


Fig. 2—Parameters defining propeller blade geometry

lar deflection was observed with a stroboscope. Since the torque meter was calibrated, this angular deflection could be translated into torque. The torque required to turn the propeller shaft without the propeller was measured at various speeds. This tare torque was subtracted for subsequent propeller tests to obtain the net torque required for rotation of the propeller.

The model propeller blades used in this investigation had the geometry of a typical aircraft propeller. The propeller shape is defined by the parameters given in Fig. 2 in terms of the pitch-diameter ratio u/D, the blade width-diameter ratio b/D, and the maximum thickness-blade width ratio h/b. This nomenclature will be clarified by reference to Fig. 3.

The RAF-6 airfoil section was chosen as the basic section because its flat bottomed surface facilitated construction and pitch measurement, and because of its past application to propellers. As will be noted from Fig. 2, the propeller blades were designed so the pitch-diameter ratio u/D would be constant over most of the propeller blade when the blade angle was set at 15 deg at the radius $r/R = 0.75$.

The propeller blades used were mounted in the hub so the blade could be set at any blade angle desired. It is apparent that if the entire blade were rotated on its own axis, the blade angle would be changed by the same amount along the entire radius. Hence, for any blade setting other than the one for which Fig. 2 is drawn ($\beta = 15$ deg at $r/R = 0.75$) the distribution of u/D with respect to r/R would change. Subsequently, when blade angle is referred to, it is the propeller blade angle at the radius $r/R = 0.75$ and will be designated by β.

Analysis of Results

Tests were run with two,-three,- and four-bladed propellers at blade angles varying from $7\frac{1}{2}$ to 20 deg by $2\frac{1}{2}$ deg increments. Enough measurements were taken for each test so that the air density, the fan rotating speed, the shaft power input to the fan, the static pressure at the fan outlet, the velocity pressure at the fan outlet and the air velocity at the fan outlet could be determined. For each propeller (two, three, or four blades) and for each blade angle, tests were run using several orifices of different diameters installed on the outlet end of the duct shown in Fig. 1. In this manner it was possible to obtain values of C_Q and C_P for a range of values of V/nD.

Performance charts giving the results of these tests are shown in Figs. 4 to 9 inclusive. In Figs. 4 to 6 inclusive the static pressure coefficient, C_{ps}, is plotted as a function of V/nD and β. The static pressure coefficient is defined by

$$C_{ps} = \frac{p_s}{\rho n^2 D^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

where p_s is the static pressure increase in pounds per square foot through the fan and all other terms are as previously defined. The total pressure coefficient, C_{pt}, is plotted as a function of V/nD and β in Figs. 7 to 9 inclusive. This coefficient is defined as

$$C_{pt} = \frac{p_t}{\rho n^2 D^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

where p_t is the total pressure rise through the fan in pounds per square foot. The total pressure is defined as the sum of the static pressure increase through the fan and the average velocity pressure at the fan outlet.

Equations 7 and 8 have the same form as Equation 6. It should be evident from the development of

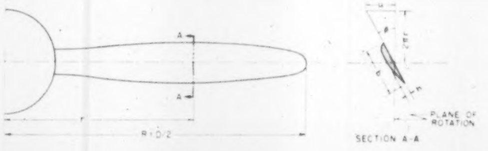


Fig. 3—Propeller blade details

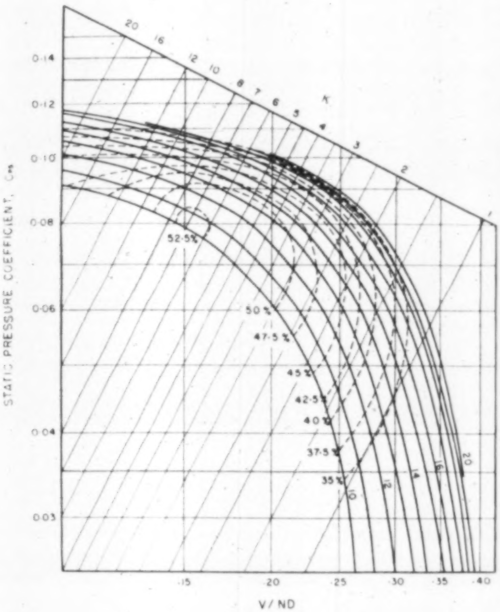


Fig. 4—Static pressure coefficient C_{ps} *vs.* advance diameter ratio V/nD for *two-bladed* propeller for various blade angles. Static efficiencies shown in contour

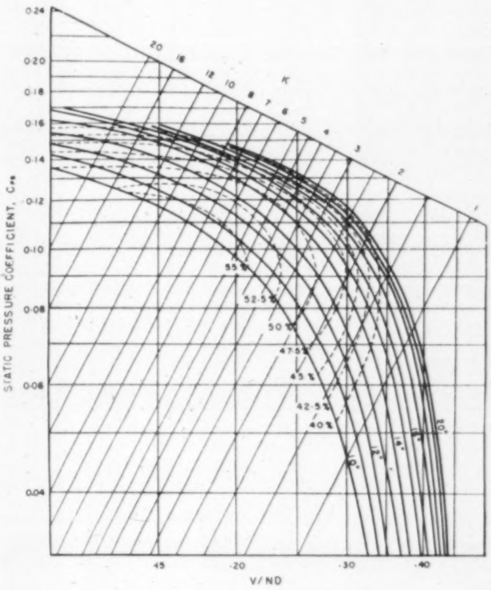


Fig. 5—Static pressure coefficient C_{ps} *vs.* advance diameter ratio V/nD for *three-bladed* propeller for various blade angles. Static efficiencies shown in contour

Equation 6 that the equation is valid using either static pressure or total pressure.

The power coefficient C_Q is not shown in Figs. 4 to 9, but rather fan efficiency contours are plotted. Fan efficiency is defined as the ratio of the fluid power to the shaft power and may be expressed by

$$\eta = \frac{pAV}{P} \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

where

A = the fan outlet area in square feet.

Substituting values of P and p from Equations 5 and 6 this equation becomes

$$\eta = \frac{C_p \rho n^2 D^2 \, (\pi D^2/4) V}{C_Q \rho n^3 D^5}$$
$$= \frac{\pi}{4} \frac{C_p}{C_Q} \frac{V}{nD} \quad \ldots\ldots\ldots (10)$$

Equation 10 may be used to define either static efficiency (η_s) or the total efficiency (η_t) depending on whether the pressure coefficient is C_{ps} or C_{pt}. Lines of constant efficiency, or efficiency contours, are shown in Figs. 4 to 9. These lines represent static efficiency η_s in Figs. 4 to 6 and total efficiency η_t in Figs. 7 to 9.

The shaft power in foot pounds per second may be computed from Equations 5 and 10. From Equation 10

$$C_Q = \frac{\pi}{4} \frac{C_p}{\eta} \frac{V}{nD} \quad \ldots\ldots\ldots (11)$$

Substituting this in Equation 5 gives

$$P = \frac{\pi}{4} \frac{C_p}{\eta} \frac{V}{nD} (\rho n^3 D^5) \quad \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

It should be noted that $C_{ps}/\eta_s = C_{pt}/\eta_t$ for a fan having a given number of blades operating at specified values of blade angle and V/nD. Hence, Equation 12 may be employed using either the static or the total pressure coefficient so long as the corresponding efficiency is used.

It was previously pointed out that the test results obtained from model tests might be expected to apply to geometrically similar prototypes. Therefore, it may be expected that the performance charts shown in Figs. 4 to 9 may be applied in the selection of aircraft propellers of similar shapes for use as fans. In these figures, curves for blade angle increments of 1 deg are plotted. These were obtained by a system of cross-plotting the experimental data which were obtained for blade angle increments of 2½ deg.

Use of Performance Charts

In the application of a fan to a duct system the pressure the fan must produce is a function of the air velocity and the geometry of the duct system. For the system in which the air is not recirculated the fan must supply the energy to produce the velocity pressure as well as the pressure loss due to friction. The total pressure rise, p_t, required of the fan, then, must be given by

$$p_t = \frac{\rho V^2}{2} + f\frac{L}{D}\frac{\rho V^2}{2}$$

$$= \left(1 + f\frac{L}{D}\right)\frac{\rho V^2}{2} \quad \ldots\ldots (13)$$

The friction factor f is, in general, a function of the Reynolds number of the flow through the duct system. A commonly used value of f for flow through galvanized sheet metal duct work is 0.02 although this coefficient does vary somewhat with Reynolds number and with surface roughness of the duct. L is the length of straight duct of diameter D in which the same friction loss would be produced as in the actual duct system.

For the purpose of convenience, a pressure drop coefficient K is now introduced and will be defined for a non-recirculating system as

$$K = 1 + f\frac{L}{D} \quad \ldots\ldots\ldots\ldots\ldots (14)$$

This coefficient K is fixed if the fan diameter D and the rate of airflow through the given duct system are specified.

Substituting the value of p_t from Equation 13 in Equation 8 gives

$$C_{pt} = \frac{K\rho V^2/2}{\rho n^2 D^2} = \frac{K}{2}J^2 \quad \ldots\ldots (15)$$

where $J = V/nD$. Since Figs. 7 to 9 inclusive are log-log plots of C_{pt} *vs.* J it is apparent that Equation 15 would appear as a straight line on these charts for given values of K. Several such lines are plotted on these charts for various values of K.

As a first step in the selection of a propeller to be used as a fan in a non-recirculating system, a tentative diameter can be chosen. Assuming that the flow rate is known, the L/D ratio for the system can be estimated by conventional methods of calculating friction loss in ducts. An average value of f, such as 0.02, may be assumed or if more precision is desired f may be evaluated taking into account the Reynolds number of flow and the inside surface condition of the duct system. In any event, once L/D and f are decided upon, the value of K is fixed. This value of K can be followed along the family of constant K lines on Figs. 7, 8 or 9 to the point of maximum efficiency. The point thus determined will fix the values of V/nD, C_{pt} and blade angle. The fan speed n may be calculated from the V/nD value since with the diameter previously decided upon the average velocity of flow V through the fan would be fixed for the given rate of air flow. With this value of n, then, and the values of C_{pt} and total efficiency read from the chart, the shaft power may be calculated from Equation 12. At this point it can be determined whether two, three, or four blades give the most advantageous values of fan speed and power required for the tentative propeller diameter selected. This procedure may be repeated for other assumed propeller diameters so that the most practical selection may be made.

For the purpose of clarifying this procedure, an example will be given.

Example: Suppose it is required that a fan supply 100,000 cfm of air at 70 F and a barometric pressure of 29.92 in. of mercury to a duct system of certain

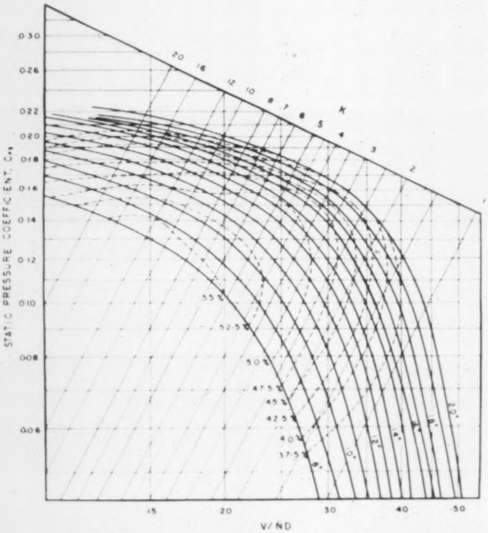
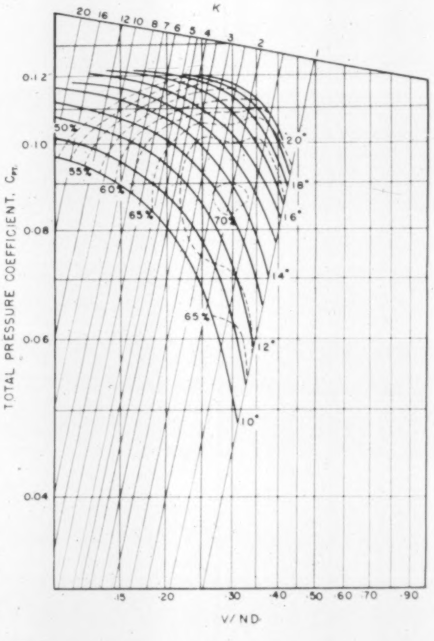


Fig. 6—Static pressure coefficient C_{ps} *vs.* advance diameter ratio V/nD for *four-bladed* propeller for various blade angles. Static efficiencies shown in contour

Fig. 7—Total pressure coefficient C_{pt} *vs.* advance diameter ratio V/nD for *two-bladed* propeller for various blade angles. Total efficiencies shown in contour



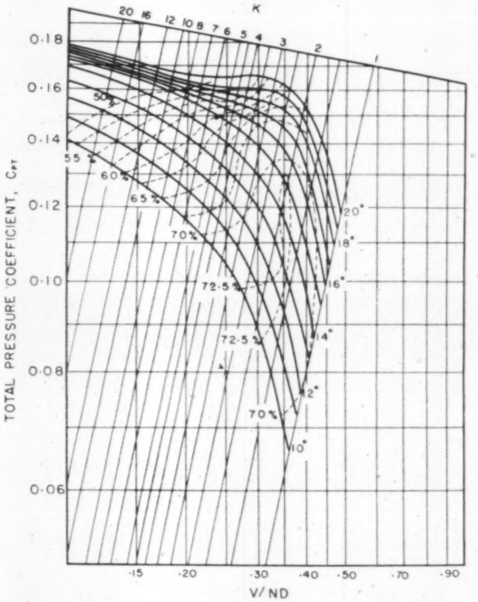


Fig. 8—Total pressure coefficient C_{pt} *vs.* advance diameter ratio V/nD for *three-bladed* propeller for various blade angles. Total efficiencies shown in contour

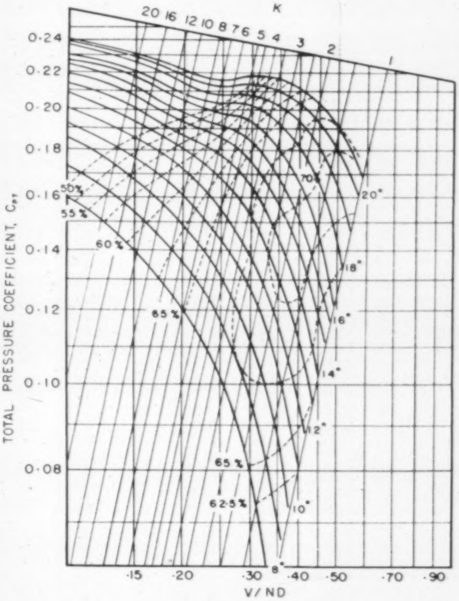


Fig. 9—Total pressure coefficient C_{pt} *vs.* advance diameter ratio V/nD for *four-bladed* propeller for various blade angles. Total efficiencies shown in contour

specified proportions and length. The system is to be non-recirculating.

Solution: A propeller diameter of 8 ft will be chosen tentatively and on this basis suppose the equivalent length of the duct system is equal to 50 fan diameters. This means that the friction loss through the duct system has been determined to be the same as the loss through a straight pipe 8 ft in diameter and 50 diameters long or 400 ft in this case. Therefore, $L/D = 50$. Assuming that the friction factor is $f = 0.02$, the value of the pressure drop coefficient from Equation 14 is $K = 1 + 0.02\ (50) = 2.0$.

At this point it is not known whether to use a two-, three-, or four-bladed propeller, but a two-bladed propeller will be tentatively selected. From Fig. 7, it is estimated that the maximum total efficiency attainable for $K = 2$ is 70 percent. This occurs for a value of $V/nD = 0.30$, $C_{pt} = 0.09$, and $\beta = 14$ deg. Since 100,000 cfm must pass through the 8 ft diameter fan, the average velocity through the fan must be $V = 4(100{,}000)/\pi(8)^2(60) = 33.2$ fps. Since $V/nD = 0.30$, $n = V/0.3D = 33.2/(0.3)(8) = 13.8$ rps.

The mass density of air is the weight density divided by the acceleration of gravity. For the stated condition of temperature and barometric pressure the weight density of air is 0.075 lb per cu ft and therefore the mass density is $\rho = 0.075/32.2 = 0.00233$ slugs per cu ft. The shaft power may be calculated by using Equation 12 which gives $P = (\pi/4)\ (0.09/0.70)\ (0.3)\ (0.00233)\ (13.8)^3\ (8)^5 = 6070$ ft-lb per sec or a horsepower of $6070/550 = 11.0$ hp. If the rotating speed of 13.8 rps is satisfactory for the power drive available for this example, further trial selections need not be made.

The rating point selected on the curve for $K = 2$, however, could be moved up or down on the curve without appreciably changing the efficiency. The location of the point selected would affect the fan speed as just calculated. If a speed appreciably below 13.8 rps were desired, the preceding calculation could be repeated using the curves for three or four blades. If this still did not yield a desirable speed it would be necessary to repeat these calculations using a different fan diameter.

In many cases for fan selection the air capacity in cubic feet per minute and the static pressure in inches of water against which this air must be moved are the initially known quantities. The conversion factor to convert pressure H in inches of water to pressure p in pounds per square foot is given by the following equation:

$$p = 5.2\,H \qquad \text{(16)}$$

If d is used to denote air density in pounds per cubic foot and g the acceleration of gravity in feet per (second) (second),

then

$$\rho = d/g \qquad \text{(17)}$$

The quantity $\rho V^2/2$ appearing in Equation 13 becomes

$$\frac{\rho V^2}{2} = \frac{dV^2}{2g} = p_v \text{ lb per sq ft} \qquad \text{(18)}$$

Now if Equation 13 is multiplied by the factor 5.2, it becomes

$$5.2\,p_t = 5.2\,p_s + f\,\frac{L}{D}\,(5.2\,p_v) \qquad \text{(19)}$$

which reduces to

$$H_t = H_v + f\frac{L}{D}H_v \ldots\ldots\ldots\ldots (20)$$

where H_t and H_v are now total and velocity pressures respectively in inches of water. Since by definition $H_t = H_v + H_s$ where H_s is static pressure in inches of water, it follows from Equation 20 that

$$H_s = f\frac{L}{D}H_v \ldots\ldots\ldots\ldots (21)$$

or rearranging

$$f\frac{L}{D} = \frac{H_s}{H_v} = \frac{H_s dV^2}{2(5.2)g}$$
$$= 0.00299\,H_s dV^2 \ldots\ldots (22)$$

In this equation V is the velocity through the fan in feet per second and its value depends on the fan diameter chosen. In the selection of a fan, however, a tentative diameter may be selected and the value of V computed corresponding to the required fan capacity. Then for the required static pressure the quantity $f(L/D)$ may be obtained from Equation 22 and substituted in Equation 14. From this point the calculations would proceed as illustrated in the example presented previously.

If a fan is installed in a duct system in which the air is recirculated through the fan, the fan is required to overcome only the friction loss in the system since the kinetic energy of flow is not dissipated. For this case Equation 13 reduces to

$$p_s = f\frac{L}{D}\frac{\rho V^2}{2} = K\frac{\rho V^2}{2} \ldots\ldots\ldots\ldots (23)$$

where

p_s = static pressure loss in the system.

K, the friction drop coefficient, is now defined as

$$K = f\frac{L}{D} \ldots\ldots\ldots\ldots (24)$$

This definition of K is applied to Figs. 4 to 6 inclusive. If the static pressure in inches of water against which the fan must operate is known, the value of $f(L/D)$ may be calculated from Equation 22. This also is the value of K for the recirculating fan as is evident from Equation 24.

The method of determining the number of propeller blades, the blade angle, the propeller rotating speed, and the shaft power for a given propeller diameter and rate of air flow for the case of the recirculating system is identical with that employed for the non-recirculating system. For the recirculating system, of course, K is defined by Equation 24 and Figs. 4 to 6 must be used.

The dimensionless equations presented in this paper are not commonly employed in fan engineering and it may be of benefit to multiply some of them by suitable constants so the terms used may be expressed in conventional units.

Equations 7 and 8 may be rewritten as

$$C_{ps} = \frac{603000\,H_s}{d\,(\text{rpm})^2D^2} \ldots\ldots\ldots\ldots (25)$$

$$C_{pt} = \frac{603000\,H_t}{d\,(\text{rpm})^2D^2} \ldots\ldots\ldots\ldots (26)$$

where

(rpm) = fan speed, revolutions per minute.
H_s = static pressure, inches of water.
H_t = total pressure, inches of water.
d = density of air, pounds per cubic foot.
D = fan diameter, feet.

Equation 12 may be expressed as

$$(\text{bhp}) = 2.62 \times 10^{-10}\left(\frac{C_{ps}}{\eta_s}\right)$$
$$(\text{rpm})^2D^2Qd \ldots\ldots (27)$$

if static pressure and static efficiency are used or as

$$(\text{bhp}) = 2.62 \times 10^{-10}\left(\frac{C_{pt}}{\eta_t}\right)$$
$$(\text{rpm})^2D^2Qd \ldots\ldots (28)$$

if total pressure and total efficiency are used. In these equations (bhp) is brake horsepower supplied to the fan and Q is the air flow through the fan in cubic feet per minute.

Another useful conversion equation is

$$\frac{V}{nD} = \frac{1.275Q}{(\text{rpm})D^3} \ldots\ldots\ldots\ldots (29)$$

where V is velocity through the fan in feet per second and n is fan rotating speed in revolutions per second. The other quantities are as defined in previous paragraphs.

Another example will now be worked out to indicate how the performance of a propeller fan geometrically similar to those tested may be predicted.

Example 2: Suppose a three-bladed propeller 9 ft in diameter running at 1000 rpm is required to deliver 114,000 cfm against a static pressure of 10.5 in. of water. The air delivered is to be recirculated through the fan. Atmospheric air density is 0.075 lb per cu ft.

Solution: From Equation 25, $C_{ps} = (603000)\ (10.5)\ /\ (0.75)\ (1000)^2\ (9)^2 = 0.104$. From Equation 29, $V/nD = 1.275\ (114000)\ /\ 1000\ (9)^3 = 0.20$. From Fig. 5 using these values of C_{ps} and V/nD, it can be seen that the blade angle must be 11 deg and the static efficiency will be 55 percent. Finally, using Equation 27, the brake horsepower is computed to be bhp $= 2.62 \times 10^{-10}\ (0.104/0.55)\ (1000)^2\ (9)^2\ (114000)\ (0.075) = 34.4$.

Conclusions

The data presented in this paper are applicable to two-, three-, and four-bladed propellers having the geometrical shape defined in Fig. 2 when operating as axial flow fans. These data are limited to the case of a propeller mounted in a round duct without hub fairing or guide vanes.

Examples have been worked out showing how a propeller may be selected for a specified air capacity and pressure rise. It was also shown how the blade angle setting and the horsepower required for a specific set of operating conditions could be determined.

The results of these model tests can be expected to be applicable to prototype fans so long as the tip speeds do not exceed $39\sqrt{T}$ fps where T is the air temperature in Rankine degrees. This corresponds to a tip Mach number of 0.8. In making this statement it is assumed that the effect of variation of the Reynolds number of flow around the propeller blades has a negligible effect on fan performance. It is believed that this is a safe assumption, particularly in the region of operation near maximum fan efficiency.

It is suggested that the methods used in this investigation might be employed whenever the performance of any fan might be required and it is not feasible to test the prototype. Tests could be conducted on a geometrically similar model and the results presented in the form given in this paper. This would serve as a basis for predicting the performance of the prototype fan.

City Hall

Philadelphia Ready to Welcome ASHVE

January 22-25, 1951

ELABORATE PLANS are under way to greet Society members, their families and friends in Philadelphia, January 22-25, 1951, when they arrive to attend the 57th Annual Meeting of the Society. The Committee on Arrangements, under the guidance of A. J. Nesbitt, general chairman, will be on hand to welcome those who arrive at the Society Headquarters at the Bellevue-Stratford Hotel at Broad and Walnut Sts.

Exposition

Along with the Society's Annual Meeting the 10th International Heating and Ventilating Exposition, also known as the Air Conditioning Exposition, will take place at the Commercial Museum from January 22-26, with an extensive display of modern equipment presenting a complete panorama of the industry's progress.

C. F. Roth, manager of the Exposition, has announced the appointment of the Advisory Committee for the Exposition as follows: Lester T. Avery, president of ASHVE, as chairman; C. S. Leopold, member of the Society's Council; J. W. McElgin, president of Philadelphia Chapter; E. L. Crosby, president of Baltimore Chapter; A. F. Metzger, president of Pittsburgh Chapter; Carl F. Kayan, president of New York Chapter; H. P. Gant and Merrill F. Blankin, past presidents of the Society. Mr. Nesbitt is also a member of the Advisory Committee, along with representatives of professional and engineering societies, trade and manufacturing associations and contractors, all of which are affiliated with the purposes of the Exposition.

CARPENTERS' HALL

Carpenters' Hall was the scene of many Colonial events

Numerous tours and inspections are being arranged for the Annual Meeting in Philadelphia, and there will be so many things to see and do in this historic city, that time will be too short, unless plans are made in advance. The Committee on Arrangements does not want anyone to leave Philadelphia with the feeling that, if there were more time, they would have been able to see so much more. Make rail, airline and hotel reservations promptly so that there will be no last minute worries.

Reservations

Hotel reservations should be sent to the Housing Bureau for ASHVE, Architects Bldg., First Floor, Phila-

M. F. Blankin
Honorary Chairman

A. J. Nesbitt
General Chairman

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Annual Meeting 1951

Philadelphia

Committee on Arrangements

A. J. Nesbitt, *General Chairman*

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Banquet—M. E. Barnard, Chairman; H. R. James, E. C. Lambert, C. J. Lubking, W. W. Malloy, H. H. Mather, G. W. Powell, Jr., G. E. Tuckerman, F. B. Wilder.

Entertainment—E. K. Wagner, Chairman; R. H. Ackermann, R. J. Augusterfer, H. H. Erickson, H. J. Faltenbacher, H. W. Goldner, J. H. Hucker, R. F. Hunger, L. P. Hynes, M. G. Kershaw, R. S. Mizener, S. R. Nusbaum, F. F. Pfeiffer, A. M. Robertson, Karl Rugart, Edward Semel, R. J. Sigel, J. K. Walters.

Exposition—C. F. Dietz, Chairman; C. G. Binder, H. W. Doerrfuss, C. J. Forve, Nicola Ginzburg, A. A. Granke, H. E. Grossman, J. F. Heim, J. J. Hucker, Jr., H. K. King, A. E. Kriebel, H. H. Mohrfeld, A. G. Mutimer, H. M. Parent, R. M. Sharp, G. F. Smith, W. D. Strause, H. N. Teuber.

Finance—A. C. Caldwell, Chairman; C. B. Eastman, Edwin Elliot, R. J. Lee, L. E. Moody.

Ladies—E. H. Dafter, Chairman; G. F. Bertrand, R. H. Smiles. Assisted by—Mmes. R. S. L. Arnold, M. E. Barnard, G. F. Bertrand, M. F. Blankin, F. H. Buzzard, L. M. Church, W. P. Culbert, E. H. Dafter, C. F. Dietz, John Everetts, Jr., H. B. Hedges, J. H. Hucker, R. F. Hunger, M. G. Kershaw, J. O. Kirkbride, C. S. Leopold, Ludwig Mack, H. H. Mather, J. W. McElgin, L. E. Moody, A. J. Nesbitt, E. K. Wagner.

Publicity—W. P. Culbert, Chairman, G. P. Alexander, A. E. D'Ambly, S. E. Plewes, R. D. Touton.

Reception—J. O. Kirkbride, Chairman; L. M. Church, Co-Chairman; R. S. L. Arnold, T. J. Atkins, Lucien Buck, P. A. Cavanagh, S. E. Farrington, H. E. Gross, H. B. Hedges, A. H. Koch, James Marshall, H. G. McCullough, F. B. Millham, H. B. Prewitt, J. J. Quinn, R. P. Schoenijahn, W. S. Scott, C. D. Shields, Pierce Timmis, L. A. Tucker.

Sessions—John Everetts, Jr., Chairman, Alan Dombro, R. E. Sexton, M. A. Sheffler.

Transportation—Isadore Director, Chairman; E. I. Curley, F. N. Darby, L. C. Davidson, J. E. Hutchison, Ludwig Mack, P. H. Yeomans.

John Everetts, Jr.

M. E. Barnard

C. F. Dietz

W. P. Culbert

J. O. Kirkbride

L. M. Church

A. C. Caldwell

delphia 3, Pa. Your reservation will be acknowledged and accommodations requested will be assigned after which confirmation will come from the hotel of your choice.

Program

The Program and Papers Committee is hard at work developing the technical program which is to be given at the technical sessions. One important group of papers will be devoted to the physiological aspects of air conditioning and it is anticipated that this will cover physiological principles, requirements for comfort, air conditioning for the prevention and treatment of disease, and industrial hygiene. Other topics proposed for discussion will include smoke measurement, solar radiation, air flow and its measurement, heat pump performance, etc.

TYPICAL RAILROAD FARES TO PHILADELPHIA

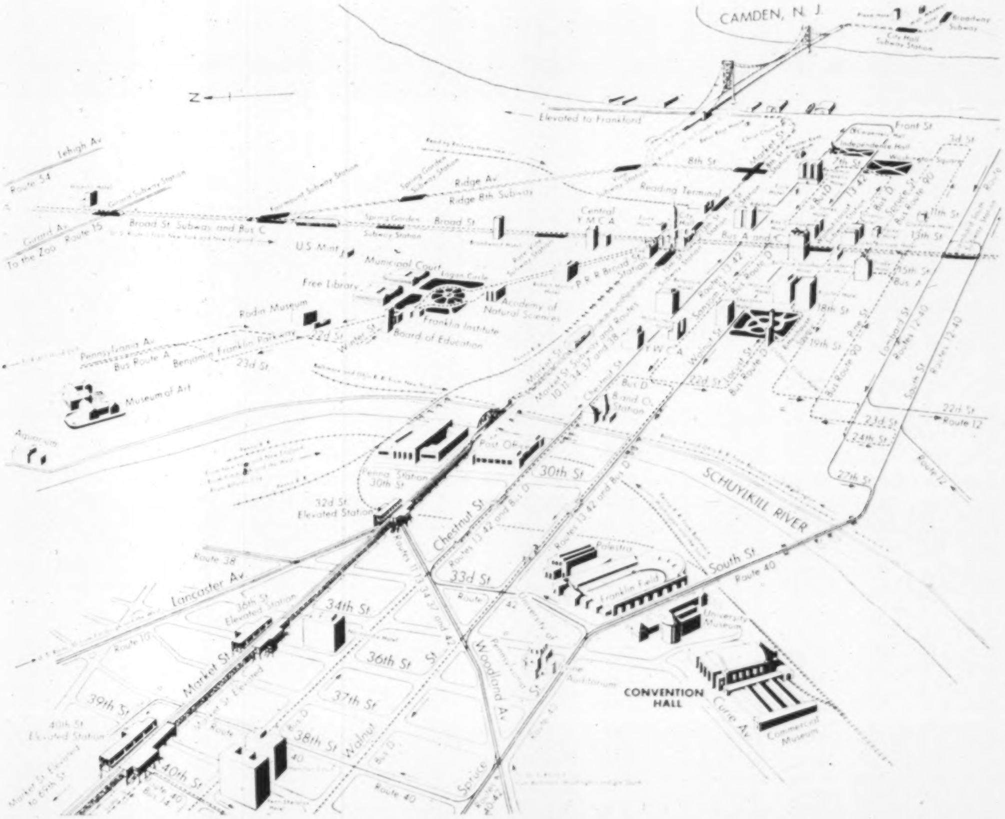
Subject to 15 percent federal tax

City	Railroad Round-trip	Pullman Lower Berth One-way
Boston	30.60	3.50
Chicago	66.35	7.20
Cincinnati	53.65	6.60
Cleveland	40.65	4.10
Columbus	45.20	5.35
Dallas	95.98	13.65
Dayton	50.35	6.00
Denver	126.75	15.25
Detroit	52.80	5.70
Houston	101.73	13.95
Indianapolis	58.40	7.20
Kansas City	93.15	10.65
Los Angeles	180.60	24.30
Montreal	42.56	5.70
New York	8.06	3.50
Omaha	95.40	10.65
Pittsburgh	30.15	3.50
Portland	186.60	24.30
St. Louis	78.30	8.65
Salt Lake City	153.45	18.25
San Antonio	110.43	15.75
San Francisco	180.60	24.30
Seattle	186.60	24.30
Spokane	162.65	21.70
Toronto	44.00	5.70
Tulsa	94.03	12.00
Washington, D.C.	12.02	3.50

It is the Committee's desire to present a well-rounded program which will be of interest to the members who are in attendance.

A welcome luncheon is planned for Monday, and on Tuesday a review of the Society's milestones of engineering accomplishments will be presented at a Public Relations Forum.

The Entertainment and Ladies Committees are planning a program which will permit seeing some of the principal places of historic interest in and around Philadelphia.


CAMDEN, N. J.
Broadway Subway
City Hall Subway Station
Z
Elevated to Frankford
Lehigh Av
Route 54
Girard Subway Station
Girard Av
To the Zoo
Route 15
Broad St Subway and Bus C
Fairmount Subway Station
Spring Garden Subway Station
Ridge Av
Ridge 8th Subway
Spring Garden Subway Station
Broad St
8th St
Reading Terminal
Central Y M C A
City Hall
Market St
Front St
Independence Hall
Washington Square
3d St
7th St
11th St
13th St
15th St
Bus A
Bus A and C
U.S. Mint
Municipal Court
Logan Circle
Free Library
Academy of Natural Sciences
Franklin Institute
Board of Education
Rodin Museum
Pennsylvania Av
Bus Route A
Benjamin Franklin Parkway
22d St
23d St
Winter St
P R R Broad St Station
Routes 13 42
Bus Route D
Sansom St
Y W C A
Walnut St
Locust St
Spruce St
Bus Route 90
Pine St
Lombard St
Routes 12-40
South St
18th St
19th St
22d St
23d St
24th St
27th St
Route 12
Museum of Art
Aquarium
Market St Subway and Routes 10 11 34 37 and 38
Chestnut St
Bus D
B and O Station
Post Office
Penna Station 30th St
30th St
32d St Elevated Station
SCHUYLKILL RIVER
Routes 13 42 and Bus D
Palestra
Franklin Field
South St
Route 40
Route 38
Lancaster Av
33d St
34th St
36th St Elevated Station
Route 10
Market St
Market St Elevated
36th St
37th St
38th St
39th St
40th St Elevated Station
40th St
Walnut
Routes 11 13 34 37 and 42
Woodland Av
University Museum
Irvine Auditorium
CONVENTION HALL
Curie Av
Commercial Museum
Route 40

JOURNAL SECTION

NOMINATIONS FOR 1951

Officers and Council

The Nominating Committee, selected in accordance with the provisions of *Article VIII — Section* 3 of the By-Laws, has submitted the following nominees for Officers and members of Council for 1951:

President
Lauren E. Seeley, Durham, N.H.

First Vice President
Ernest Szekely, Milwaukee, Wis.

Second Vice President
Reg F. Taylor, Houston, Tex.

Treasurer
Howard E. Sproull, Cincinnati, Ohio

Members of Council
Three-Year Term

John H. Fox, Toronto, Ont., Canada
L. N. Hunter, Johnstown, Pa.
Neil H. Peterson, San Francisco, Calif.
Benjamin H. Spurlock, Jr., Boulder, Colo.

Respectfully submitted,
NOMINATING COMMITTEE
R. T. Kern, *Chairman*
D. M. Mills, *Secretary*

M. F. Blankin
L. A. Burch
F. W. Chambers
Joseph Davis
S. H. Downs
Leo Garneau
E. V. Gritton
Fred Janssen
T. F. Rockwell

Alternates
R. C. Jordan
W. M. Wallace, II

In accordance with the provisions of the Society's By-Laws ballots containing the names of the above candidates will be sent to the membership prior to the Annual Meeting in January.

Article VIII

Section 4. Other Nominations. Nominations of officers and members of the Council, other than those nominated by the Nominating Committee, and nominations of members of the Committee on Research, other than those nominated by the Council, may be made in writing by at least fifty (50) members eligible to vote, upon presentation of such nominations, with each nominee's consent, to the Executive Secretary at least sixty (60) days prior to the opening of the first session of the Annual Meeting, whereupon the nominees' names shall be placed upon the ballot with a notation that they are presented by members independent of the Nominating Committee.

Section 5. Voting. Voting at any meeting may be in person or by proxy, but only the Executive Secretary and MEMBERS of the Society shall be eligible to act as proxies. Proxies shall not be valid for more than three (3) months from dates of execution. The Executive Secretary and the MEMBERS acting as proxies shall hold the ballots of their principals secret and confidential. Voting for election of officers, Council members, members of the Committee on Research, on proposals to amend these By-Laws, and on questions required to be referred to the Society pursuant to *ARTICLE V, Section 2,* shall be by secret ballot. In the event of any tie vote, the Council shall decide the vote.

Section 6. Ballots. Together with notice of the Annual Meeting, the Executive Secretary shall forward appropriate proxies and ballots to members entitled to vote. The proxies and ballots shall contain spaces for write-in names.

Members of Committee on Research

The election of the Committee on Research is governed by the By-Laws for the election of Officers, with the exception that members of the Committee on Research are nominated by the Council.

In accordance with the provisions of *Article VII — Section 3 (h)* the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January 1951.

Committee on Research
Three-Year Term

A. B. Algren, Minneapolis, Minn.
John Everetts, Jr., Philadelphia, Pa.
T. H. Smoot, Marshalltown, Ia.
Thomas A. Walters, Detroit, Mich.
William N. Witheridge, Detroit, Mich.

Article VII

Section 3. General Committees. (h) Committee on Research, consisting of fifteen (15) MEMBERS, nominated by the Council or as provided in *ARTICLE VIII, Section 4,* and elected by the Society in the manner of elected officers..........

NOMINEES FOR 1951 OFFICERS

Lauren E. Seeley
Durham, N. H.

For President

Lauren E. Seeley, Durham, N. H., Dean of the College of Technology and Director, Engineering Experiment Station, University of New Hampshire, was born on November 8, 1898 at Meriden, Conn. He attended Yale University from which he received his Ph.B. degree in 1921, his M.E. in 1924 and his LL.B. in 1935.

While preparing for his degrees he taught courses in mechanical engineering at Yale and in 1925 was put in charge of a course in heating and ventilating, remaining at the University until 1945 when he was appointed to his present position at the University of New Hampshire.

During the war, Dean Seeley served as regional advisor in Connecticut and Rhode Island for the engineering, science and management war training program of the U. S. Office of Education and was special consultant to the OPA on fuel oil and coal rationing problems. He also served as consultant on engineering and manpower problems for a number of government agencies, trade associations and private firms.

Dean Seeley is the author of numerous technical codes and papers which have been published in the Society's JOURNAL and TRANSACTIONS. His research work has been concerned chiefly with heating and ventilating, including studies of wood burning devices and the effect of relative humidity on the respiratory system.

A member of the Society since 1930 he has had an active interest in its activities. He served a three-year term on the Council from 1941 and during this time served on several Council Committees, such as the Executive, Finance and Standards. He also served a three-year term as a member of the Publication Committee, serving as its chairman in 1946. In 1948 he was elected Treasurer of the Society and served as ex-officio member of the Executive and Finance Committees of the Council. In 1949 he was Second Vice President of the Society and chairman of the Finance Committee, and a member of the Executive Committee as well as of the Special Federal Liaison Committee. He is now serving as First Vice President and as chairman of the F. Paul Anderson Committee.

Greatly interested in research, he served as a member of a number of the Research Technical Advisory Committees, and is a member of the current TAC on Human Calorimetry.

Dean Seeley was active in the affairs of the Connecticut Chapter since it was organized in 1940. He was elected president of the Chapter during the 1940-41 season and following his term of office he served as a member of its board of governors.

Dean Seeley is also Chairman, Engineering Division, *Association of Land-Grant Colleges and Universities*, Vice Chairman, Green Mountain Section, *American Society of Mechanical Engineers*, and a member of the *American Society for Engineering Education*, *American Association for Advancement of Science*, *Forest Products Research Association*, Sigma Xi, Tau Beta Pi, Phi Kappa Phi, Sigma Pi Sigma, New Hampshire Academy of Science, *Yale Engineering Association*, *Graduate Science Society*, Durham, N.H. and Acacia Fraternity, University of New Hampshire. Dean Seeley is a registered professional engineer in Connecticut and New Hampshire.

For First Vice President

Ernest Szekely, president, Bayley Blower Co., Milwaukee, Wis., was born July 24, 1888 and graduated in 1910 from the University of Budapest with an M.E. degree.

Following his graduation he spent two years at the University as assistant professor of thermodynamics, heating and ventilating, and in 1912 he became associated with Jeffrey Mfg. Co. and Guarantee Construction Co., New York, where he designed elevating systems and did general engineering work. In 1914 he joined the staff of the American Blower Co. at Detroit, as research engineer in heating and ventilating.

Mr. Szekely joined the Society in 1920 and has been active in both the Northern Ohio and Wisconsin Chapters, as well as in Society activities. He has served as a member of the Council, 1945 to 1947, and on many Society committees, including the Nominating, Code Committee for Exhaust Systems. In 1949 he served as ex-officio member of the Executive and Finance Committees of Council, and as chairman of the 1950 Finance Committee.

He has also served on the Research Technical Advisory Committees on Infiltration in Buildings, Effect of Entering Temperature and Velocity on the Temperature and Distribution of Air Within an Enclosure, serving as its chairman in 1936, and as chairman of the Committee on Air Distribution in 1937 and from 1945 to 1950. He was also a member of the Fan Test Code Committee.

Ernest Szekely
Milwaukee, Wis.

He served the Northern Ohio Chapter as its vice-president and president in 1923 and 1924, and the Wisconsin Chapter as second vice president, first vice president and president in 1933, 1934 and 1935, consecutively, and as a member of its Board of Governors from 1936 to 1938. Mr. Szekely also served on many code and other committees of the Wisconsin Chapter.

Mr. Szekely has published engineering articles in the technical field and is among those listed in *Who's Who in Engineering*. He is also a member of the Rotary Club.

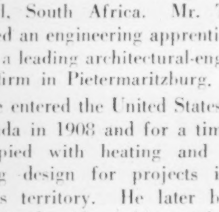
For Second Vice President

Reg F. Taylor, consulting engineer, Houston, Tex., was born in Toronto, Canada, and educated in public and preparatory schools in England and Pietermaritzburg, Natal, South Africa. Mr. Taylor served an engineering apprenticeship with a leading architectural-engineering firm in Pietermaritzburg.

He entered the United States from Canada in 1908 and for a time was occupied with heating and ventilating design for projects in the Texas territory. He later became associated with architectural firms in Texas and Kansas City as a mechanical-electrical engineer, until the outbreak of World War I.

During World War I he was a member of the 110th Engineers, 35th Division (Kansas-Missouri) with one year overseas duty.

In 1919, after severance from the Army, he entered private practice as consulting engineer in Dallas, Tex. This office was maintained until 1938, when it was transferred to Houston, Tex., and practice was continued there.



Reg F. Taylor
Houston, Tex.

The extent of his practice has covered heating, ventilating, air conditioning, and electrical design for various types of buildings, among which are included federal housing projects, hospitals, schools, theaters, industrial plants, estimated to be well over a total of 1000 buildings. Professional operations have been in several states, principally Texas, Louisiana, Oklahoma, Arkansas and Alabama, with some work in Arizona and Missouri.

Mr. Taylor joined the Society in 1915 and is one of the Charter members of the Kansas City Chapter. He was located in Dallas when the Texas Chapter was first organized in 1937 and served as its President, then when the Texas Chapter was divided into the North Texas and South Texas Chapters, he served as President of the South Texas Chapter in 1939. He also served as a member of its Board of Governors in 1940, 1943, and 1944 and on numerous Chapter Committees.

Currently, Mr. Taylor is serving as Treasurer of the Society and was elected a member of the Society's Council for a three-year term, 1947-49. During these years he served as Chairman of the Special Committee on Chapter Relations in 1947, as Chairman of the Membership Committee in 1948, and as Chairman of the Program and Papers Committee in 1949.

Mr. Taylor is a registered professional engineer in the State of Texas and a member of the *Texas Society of Professional Engineers*, the *American Institute of Electrical Engineers*, the Rotary Club of Houston, Houston Engineers Club, the Houston Club and Houston Electric Club.

For Treasurer

Howard E. Sproull, Cincinnati, Ohio—Mr. Sproull, division sales manager of American Blower Corp., was born in New Alexandria, Pa. He attended the Bedford, Indiana High School and Bedford Business College, and was a member of the Class of 1912 in mechanical engineering, including heating and ventilating, of Purdue University, West Lafayette, Ind.

Howard E. Sproull
Cincinnati, Ohio

In 1907 he was employed in the engineering department of the Virginia and Southwestern Railways on construction work, and two years later he joined the staff of the Corn Products Refining Co., Granite City, Ill., as an automatic machine designer. His first association with the American Blower Corporation was in 1911 and since then he has served as sales engineer and manager of several of their branch offices.

During the first World War he served as a first lieutenant in the Air Corps and took part in the American Relief Administration in Czechoslovakia in 1919.

Mr. Sproull joined the Society in 1920, soon after his discharge, and immediately took an active interest in Society affairs. He has served on many of the Society Committees including the Chapter Relations Committee, the Chapter Delegates Committee, and the Nominating Committee. More recently, Mr. Sproull has served on the Constitution and By-Laws Committee for 1947-48-49 and is the current chairman of the Charter and By-Laws Committee. A current member of the Council, Mr. Sproull was elected a three-year member in 1948 and in 1949 served on the Council's Finance Committee.

He has also taken an active part in the Cincinnati Chapter, serving as its president, vice president, treasurer, secretary and as a member of its board of governors, as well as serving on all Chapter Committees.

He also holds membership in the Scabbard and Blade, Iron Key, Cincinnati Country Club, the Phi Delta Theta, and the Masonic organization.

NOMINEES FOR 1951 MEMBERS OF COUNCIL

Three-Year Term

John H. Fox, sales manager, Minneapolis-Honeywell Regulator Co., Ltd., was born on May 24, 1903 in Toronto, Ont., Canada. He attended the University of Toronto and received a B. A. Sc. degree in mechanical engineering upon graduation.

John H. Fox
Toronto, Ont.

Following graduation, Mr. Fox stayed on at the University from 1927-28 as an instructor in the hydraulics laboratory. In 1928 he joined the staff of the C. A. Dunham Co., Ltd., of Toronto, as assistant to the chief engineer, with whom he was employed until 1934. He was associated with the Minneapolis-Honeywell Regulator Co., Ltd., in the capacity of sales engineer from 1934-39. Mr. Fox left Minneapolis-Honeywell in 1940 to join the Canadian Army as a field workshop officer with the Royal Canadian Electrical and Mechanical Engineers. He served overseas with the Canadian and British 2nd Army in Northwest Europe. After the war was over, he returned to Minneapolis-Honeywell as sales and installation manager.

Mr. Fox is a member of the Ontario Chapter of the Society, having served on its board of governors in 1938 and 1939 and in 1946-47-48. Last year he served as the vice president and this year as president of the Ontario Chapter. He is also a member of the Society's Chapter Relations Committee.

He holds membership in the *Engineering Institute of Canada*, the *Insitution of Mechanical Engineers*, of London, England, the *Royal Canadian Military Institute*, and the Toronto Board of Trade. Mr. Fox is a past master of the University Lodge, A. F. & A. M., of Toronto.

L. N. Hunter, vice president of research, The National Radiator Co., Johnstown, Pa., was born on August 27, 1903, in Brampton, Ontario, Canada, where he received his preliminary education. He attended the University of Toronto and received his degree of B.A.Sc. from the University in 1925.

L. N. Hunter
Johnstown, Pa.

Mr. Hunter's first assignment was with the Bryant Heater Co., Cleveland, Ohio, as assistant research engineer. After four years he joined the staff of the National Radiator Co., Johnstown, Pa., as gas engineer. His many duties included designing and testing gas-fired house heating boilers and adapting controls; he also designed and tested special cast-iron, gas-fired boilers for treating crude oil emulsions. In 1932 he was made assistant manager of the research department, where he supervised the designing, testing and research work on coal, oil and gas-fired boilers, oil burners, stokers, radiators, convectors and air conditioning equipment, and accessories and controls. Mr. Hunter was promoted to manager of the Research Department in 1935 and in 1941 was appointed vice president and manager of research. He has served on the Board of Directors since 1943.

Mr. Hunter joined the Society in 1935 and served on Technical Advisory Committees on Radiation and Comfort, and on the Solid Fuels Committee from 1939 to 1942. In 1948 and 1949 he was appointed chairman of the Society's Committee on Research and served as a member of its Executive Committee in 1946 and 1947 and as chairman of its Executive Committee during 1948-49 and is currently serving as a member of the 1950 committee. Mr. Hunter served on the TAC on Fuels in 1947, the TAC on Panel Heating and Cooling in 1948, and is currently serving on the TAC on Combustion and on Panel Heating and Cooling, and on Hot Water and Steam Heating.

He is also a member of the *ASME*, *ACS*, Sunnehanna Country Club, and the Bachelors Club.

Neil H. Peterson
San Francisco, Calif.

Neil H. Peterson, owner of the Neil H. Peterson Co., San Francisco, Calif., was born on June 27, 1896 at Boone, Iowa. He attended Lake

View High School of Chicago, the Culver Military Academy and the University of Illinois.

From 1919-25, Mr. Peterson was associated with the American Radiator Co. as a salesman of heating and ventilating equipment in the company's Seattle and San Francisco branches. In 1925, he joined the staff of Geo. H. Tay Co. of San Francisco, for a year, as manager of the Heating Dept. Mr. Peterson left that company in 1926 and formed his own company. He serves as manufacturers' representative for such companies as the Air Maze Corp., Cleveland, Ohio, Anemostat Corp. of America, New York, N.Y., Dravo Corp., Pittsburgh, Pa., The Mercoid Corp., Chicago, Ill., and The Trane Co., La Crosse, Wis.

Mr. Peterson joined the Society in 1937 and served on the Nominating Committee in 1941, in 1947 as chairman and in 1949 as vice chairman of that committee. In 1941 he served on the Society's Chapter Delegates Committee, and in 1948 and 1950 served as the Chapter alternate and in 1949 as the Chapter delegate for the Golden Gate Chapter. He was vice president of the Golden Gate Chapter in 1940 and president in 1941 and served on its board of governors from 1939-43.

He also is a member of the following other societies and organizations: Engineers Club of San Francisco, Olympic Club, Bohemian Club, Commonwealth Club of San Francisco, Presidio Golf Club, Argonne Lodge - F. & A. M., San Francisco Consistory No. 1-M.R.S., Islam Temple-A.A.O.N.M.S. of San Francisco.

Benjamin H. Spurlock, Jr.
Boulder, Colo.

Benjamin H. Spurlock, Jr., associate professor of mechanical engineering, University of Colorado, Boulder, Colo., was born on July 19, 1907 at Lithonia, Ga. He attended Georgia Institute of Technology, Massachusetts Institute of Technology, the University of California and Yale University, receiving an M.S. degree.

Prior to becoming instructor at the University of Colorado, he was in the accounting department of the Southern Railway, Atlanta, Ga., was sales engineer for the Union Oil Co. of California, was design engineer for Eagan Cotton Mills, Atlanta, followed by a year under Prof. L. M. K. Boelter at the College of Engineering, University of California, Berkeley. He later spent three years with Pratt & Whitney Aircraft Co. on confidential research.

In 1940 he became an instructor with the University of Colorado, in 1942 becoming an assistant professor of mechanical engineering, and in 1947 becoming an associate professor. Between 1944-46 he was a visiting lecturer in mechanical engineering with Yale University.

Professor Spurlock is listed in *Who's Who in Engineering, Who's Who on the Pacific Coast,* and *American Men of Science.* He is also a member of *ASME, ASRE, ASEE,* Sigma Xi, honorary research fraternity, Pi Tau Sigma, honorary mechanical engineering fraternity, and Sigma Phi Epsilon.

DEHUMIDIFER IMPROVES DAMP BASEMENTS

The damp basement presents a serious summer-time problem, in many parts of the country. Where the temperature reaches the eighties and nineties in the daytime, and the humidity is equally high, the moisture in the air condenses on the cool basement floor, and on cool walls, and on cold water pipes, resulting in floors that continue to stay wet.

Clothes refuse to dry: they even become damp and mildewed while waiting to be washed. Furnaces rust, costly tools are ruined, luggage and leather sports equipment gather mold, and the dampness from the basement infiltrates into the house causing an unpleasant, musty odor.

To solve this problem, engineers in the air conditioning and refrigeration field have developed a dehumidifier to remove excess moisture and humidity from the air of any confined area.

The fan of the dehumidifier draws humid air over the drier coil which is refrigerated so that condensation forms on its surface. This collected water drips into a basin, then into a container or may be directed to a drain.

The air is then heated as it passes over the condenser coil and is sent out into the room much drier than before but at about the original room temperature.

The following table shows typical amounts in gallons of water removed in 24 hours under conditions of relative humidity and temperature as listed:

If the room temperature is	And the relative humidity is			
	60%	70%	80%	90%
60 F	0.7	1.52	1.7	2.1
70 F	1.1	1.7	2.4	2.85
80 F	1.2	2.5	3.1	3.58
90 F	2.0	2.9	3.81	4.27

BUCKLEY, LAMM AND LOCKLIN JOIN TIMKEN

Three Junior Members of the Society have been appointed project engineers to the staff of Timken Silent Automatic Div., Timken-Detroit Axle Co., at its plant in Jackson, Mich., according to a recent announcement by T. A. Crawford, general manager.

N. A. Buckley, newly appointed a project engineer in furnace research and development, obtained a bachelor's degree in mechanical engineering in 1941 and a master's degree in 1947, both at the University of Illinois. From 1943 through 1946, he served as an engineer officer in the United States Navy, and since 1947 has been doing technical work in warm air heating and air conditioning at the University of Illinois.

K. L. Lamm, new project engineer in boiler research and development, was previously employed as research engineer at the University of Illinois, department of mechanical engineering. His education includes a B.S. degree in mechanical engineering, University of Wisconsin, 1917, and a master's degree at the University of Illinois the following year.

D. W. Locklin, formerly research engineer at the ASHVE Research Laboratory, Cleveland, Ohio, has been appointed a project engineer in oil burner research and development. He received a bachelor's degree in mechanical engineering at the University of Illinois in 1947 and a master's degree in heat-power mechanical engineering at Case Institute of Technology this year.

Summary of Chapter Meetings*

ANNUAL OUTING OF WESTERN NEW YORK CHAPTER

The 1950 golf meeting of the Western New York Chapter was held at the Cherry Hill Country Club, Ridgeway, Ontario, on August 15. Forty-four were present for dinner, while twenty-six played golf. Low gross for the day went to Glen Tyler with a 76 while Bob Hill scored an 80 as runner-up, and Bill Maloney and John Quackenbush tied for third place with an 81. Frank Langley, with two birdies, won a prize and Tom Grieves with a net 76 captured the kickers handicap.

Others whose skill was rewarded were: General Allan Reif, Quentin Thompson, Joseph Davis, Paul Wycoff, Leonard Reed, Bill Summers, Chuck Kaup, Van Harwood, Park Hedley, and Jim Magee. Bob Weber and Bill Ellwood shared the honor of having the most "sevens." Non-golfers L. P. Saunders, Frank Weber, and John Bryce, Chapter President were given special awards.

The meeting was held under the co-chairmanship of Walter Voisinet and Frank Weber, with regrets from everyone present at the absence of Walter Voisinet who had been recently confined to the hospital with pneumonia. All were glad to hear that Walter was doing well and would soon again be playing golf in the low seventies.

• *NEBRASKA*—July 19, 1950. The meeting was called to order by Pres. G. W. Colburn at the Castle Hotel, Omaha, and the minutes of the previous meeting were read and approved. The chief purpose of this meeting was to appoint the various committees to serve for the coming season. The following committee chairmen were announced as follows: *Attendance*—L. E. Camp; *Auditing*—E. C. Webber; *Legislation*—M. G. Lehman; *Membership*—W. B. Howard; *Program*—M. K. Rush; *Public Relations*—H. H. Ulrich; *Research & Development*—J. S. Latenser.

The meeting adjourned at 7:30 p.m.

• *NORTHEASTERN OKLAHOMA*—August 8, 1950. Pres. A. D. Holmes presided at the meeting which was held at Smiths Restaurant, Tulsa, and the secretary called the roll and read the minutes of the previous meeting, which were approved as read.

The program for the evening was an open forum discussion concerning the pertinent local aspects of the new refrigeration code and its application in Tulsa. The discussion was very lively and interesting and beneficial to all. The meeting adjourned at 9:40 p.m. Attendance 21. Attendance ratio 0.54.

• *NORTHEASTERN OKLAHOMA*—July 11, 1950. Members and guests met at Smiths Restaurant, Tulsa, for a dinner meeting and Pres. A. D. Holmes called the business meeting to order at 7:50 p.m., at which time the secretary called the roll and the minutes of the previous meeting were read and approved. C. H. Dollmeyer, Jr., introduced the speaker of the evening, R. D. Reed, chief engineer of the John Zink Company. Mr. Reed's subject was *Radiant Heat Transfer* and dealt primarily with the utilization of heat from gaseous fuels. The meeting was adjourned at 9:25 p.m. Attendance 19. Attendance ratio 0.50.

• *NORTH TEXAS*—July 17, 1950. The meeting was called to order by Pres. Herman Blum at the Melrose Hotel, Dallas, and the members and guests introduced themselves. The minutes of the May meeting were read and approved and the entertainment committee made a report. The speaker of the evening was T. H. Anspacher, district manager, Buffalo Forge Co., Dallas. With the help of slides and a black board, Mr. Anspacher explained the advantages and disadvantages of the various types of pumps that are used in heating, ventilating and air conditioning applications. Mr. Anspacher made a fine presentation, and according to the report of the secretary the talk was well received by those present. The meeting adjourned at 9:55 p.m. Attendance 65. Attendance ratio 0.35.

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*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

JOURNAL SECTION

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society, or mailed to all members. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month 42 applications for membership, 2 reinstatements, and 4 advancements have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by October 31, 1950, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Aken, E. L., Field Engr., Barber-Colman Co., Milwaukee, Wis. References: V. P. Hansen, D. E. Horock, L. C. Plaehn, H. J. Sieverts.

Beckett, M. D., Designer, Harry H. Herman, Denver, Colo. References: H. H. Herman, J. J. Johnson, H. K. Marshall, B. H. Spurlock.

Black, L. C., Pres., Heating and Cooling, Inc., Charleston, W. Va. References: I. C. Baker, R. A. Gonzalez, E. J. Kelly, L. O. Johnson.

Burns, A. E., Pres., Burns Heating Supply Co., Inc., Long Island City, N. Y. References: John Berger*, F. E. Hockensmith, C. J. Low, A. A. Olson.

Byard, B. R., Agent, Hartzell Propeller Fan Co., Piqua, Ohio. References: R. A. Albrecht, R. G. Anderson, D. D. Herrmann, G. V. Sutfin.

Carr, H. L., Heating Engr., Hart Furnace & Supply Co., Louisville, Ky. References: J. M. Kane, Arthur Nutting, H. W. Pound, K. F. Robinson.

Cleland, J. H. W., Planning Engr., West Penn Power Co., Pittsburgh, Pa. References: C. M. Fife, W. F. Keist, E. H. Riesmeyer, Jr., C. H. Schneider.

Coblentz, C. W., Mech. Engr., National Bureau of Standards, Washington, D. C. References: P. R. Achenbach, R. S. Dill, W. O. King, E. J. Stearns, Jr.

Debell, C. A., Owner, The Debell Supply Co., Sheboygan, Wis. References: N. E. Hill, R. G. Koch, F. J. Nunlist, Jr., O. J. Ress.

De Jaco, Ferdinand, Mech. Engr., I. C. Disher, Cons. Engr., Cincinnati, Ohio. References: J. W. Bunting*, I. C. Disher*, W. J. Killian, C. R. Neeson*.

Eberle, L. V., Jr., Engr., Johnson & Lenz, Memphis, Tenn. References: R. W. Johnson, J. B. Lammons, N. C. Ledbetter, A. W. Lenz.

Eberle, L. V., Sr., Sales, N. O. Nelson Co., Memphis, Tenn. References: C. S. Fischer, J. D. Flinn, Charles Hughes, N. C. Ledbetter.

Heapy, M. O., Partner, Schweiger, Heapy & Associates, Dayton, Ohio. References: K. B. Little, R. J. Perkins, C. D. Weaver, Jr., W. G. Wilkins.

Hodge, H. B., Design & Estimating Engr., Gardner & Naylor P/L, South Melbourne, Australia. References: A. E. Atherton, J. W. Picot*, T. A. Roseby, F. Williams*.

Hughes, W. R., Sales Engr., Hughes Heating Co., Memphis, Tenn. References: J. B. Lammons, N. C. Ledbetter, A. W. Lenz, H. H. Wilson.

Ives, Norton C., Chief, Dept. of Agricultural Engineering, Inter-American Institute of Agricultural Sciences. References: H. M. Black*, J. D. Long*, J. F. Sandfort, A. W. Turner*.

Jensen, C. O., Mech. Designer, Wyatt C. Hedrick, Dallas, Tex. References: J. R. Joiner*, James Leon*, H. J. Lohrman, Jr., F. A. Traino*.

Lakes, P. G., President, Lakes Ltd., Vancouver, B.C., Canada. References: R. F. Johnston, C. W. Leek, Walter Leek, D. W. Thompson.

Laux, L. C., Jr., Application Engr., The John Harrison Co., Etna, Penn. References: J. H. Allison, J. W. Sherrer, W. D. Simpson, E. C. Smyers.

Lohrey, C. N., Engr., Lieb-Jackson Co., Dayton, Ohio. References: R. C. Allen, R. B. Jackson, R. J. Perkins, C. D. Weaver, Jr.

Malcolm, R. A., Sales Engr., Johnson Temperature Regulating Co. of Canada, Ltd., Vancouver, B. C., Canada. References: H. W. Alyea, P. D. Gayman, M. M. Herrick, F. R. Vernon.

Margetts, J. L., Owner, The Stokermatic Co., Salt Lake City, Utah. References: A. R. Curtis, E. V. Gritton, E. J. Watts, D. R. Wilde.

McBride, C. J., Supervisor, Airtemp Heating Laboratory, Airtemp Division of Chrysler Corp., Dayton, Ohio. References: M. J. Gibbons, Jr., R. A. Gonzalez, E. A. Jones, C. R. Neeson*.

Neill, David, Sales Repr., Farrel-Birmingham Co., Buffalo, N. Y. References: J. J. Bechtol, R. C. Reineke, E. W. McNamee, D. J. Wood.

Newell, M. A., Jr., Student Engr., The Austin Co., Cleveland, Ohio. References: R. D. Anderson, W. W. Greiling, R. E. Leising, F. H. Pasiadis.

Panner, W. T., Sales, John Harrison Co., Pittsburgh, Pa. References: J. H. Allison, J. W. Sherrer, W. D. Simpson, E. C. Smyers.

Pickrel, D. L., Jr., Mgr., C. L. Mahoney Co., Dayton, Ohio. References: W. J. Killian, R. D. Perkins, John Schweiger*, C. D. Weaver, Jr.

Podesta, Renzo, Mgr., Societa Italiana Apparecchiature Termiche, Milano, Italy. References: Aldo Gini, Giuseppe Marzorati, Mario Santagostino, Mario Speluzzi*.

Power, J. D., Mech. Engr., Vonnegut, Wright & Yeager, Terre Haute, Ind. References: S. M. Hannig*, Wallace Kinser*, E. S. Johonnott, R. O. Yeager, Jr.*

Ramsey, G. B., Jr., Engr., T. J. O'Brien Engineering Co., Memphis, Tenn. References: J. A. Cooper, J. B. Lammons, T. J. O'Brien, C. E. Wynn.

Robbins, J. C., Mech. Designer, Black and Veatch, Kansas City, Mo. References: D. M. Allen, Carl Clegg, W. K. Dyer, P. C. Leffel.

Romine, T. B., Jr., Ass't. Mech. Engr., Wyatt C. Hedrick, Ft. Worth, Tex. References: R. A. Grimmer, Fred Manget, Jr., B. R. Miller, J. L. Tye.

Schreiner, R. F., Research, Pittsburgh Corning Corp, Port Allegany, Pa. References: F. A. Joy, E. R. Queer, P. H. Schweitzer*, R. L. Stanley.

Schweiger, J. M., Partner, Schweiger, Heapy & Associates, Dayton, Ohio. References: R. C. Allen, R. J. Perkins, C. D. Weaver, Jr., W. G. Wilkins.

Smith, E. A., Sales Engr. in Charge, Johnson Service Co., Memphis, Tenn. References: E. E. Scott, W. E. Thorpe, T. J. O'Brien, J. B. Lammons.

Sweet, J. E., Service Specialist, Milwaukee Gas Light Co., Milwaukee, Wis. References: N. E. Hill, R. G. Koch, F. J. Nunlist, Jr., O. J. Ress.

Thompson, H. B., Chief Engr., Penneys, Brisbane, Australia. References: D. E. Coleman*, J. H. Kemp*, A. Platt*, P. O. Regan*.

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*Non Member

Van Kirk, S. M., Tech. Secy., Insulation Board Institute, Chicago, Ill. References: D. B. Anderson, R. S. Dill, Cyril Tasker, M. S. Wunderlich.

Wickert, J. W., Jr. Engr., The Cincinnati Air Conditioning Co., Cincinnati, Ohio. References: R. A. Albrecht, Jr., R. J. Hanschen, H. W. Moore, F. W. Wilson.

Winston, A. D., Jr. Sales Engr., S. J. O'Brien Sales Corp., New York, N. Y. References: T. Balkin*, H. C. Rockett*, Dewey Rothkrug*, Ralph Torop.

Wolfson, H. A., Mech. Engr., Alaska Native Service, Anchorage, Alaska. References: J. H. Bonebrake, R. C. Chewning, J. D. Kroeker, R. W. Peterson.

Yin, C. L., Asst. Mgr., American Engineering Corp., Hong Kong. References: J. A. Bentley*, James Holt, Y. W. Lee*, W. S. B. Wong.

REINSTATEMENTS

Blackmore, N. L., President, Automatic Gas Equipment Co., Pittsburgh, Pa. References: G. M. Comstock, E. W. Meyer, E. H. Riesmeyer, Jr., C. H. Schneider.

Phillips, W. J., Sales Engr. & Estimator, Chas. M. Olmstead, Inc., Detroit, Mich. References: L. A. Burch, D. S. Falk, F. G. Sponenburg, K. J. Wagoner.

ADVANCEMENTS

Daniels, D. D., Mgr., Trane Company of Canada, Limited, Regina, Sask., Canada. References: J. H. Bevan, S. L. V. Fisher, K. E. O'Neill, H. M. Treleaven.

Jeffers, R. G., Draftsman, Gieske Sheet Metal Co., Kansas City, Mo. References: D. M. Allen, Carl Clegg, H. H. Lewis, E. E. Ralston.

Kice, J. W., Asst. Nat'l Sales Mgr., The Coleman Company, Inc., Wichita, Kan. References: R. F. Bauer, E. C. Blood, J. L. Lear, Charles Yoe.

Tierney, L. F., Partner, Mulch Brothers, Hollidaysburg, Pa. References: I. H. Geiger, Warren Hinks*, F. C. McIntosh, R. B. Stanger.

*Non-Member

MEL J. STEVENSON JOINS EASTERN ENGINEERING FIRM

Mel J. Stevenson has announced that he has joined the staff of Marchant & Minges, civil and structural design engineers, West Hartford, Conn., as a consulting engineer on mechanical electrical design and the organization therefor.

Mr. Stevenson, a member of ASHVE since 1935, was formerly principal of Mel J. Stevenson & Assocs., consulting engineers, Chicago, Ill.

John R. Allen Memorial Library

The ASHVE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

> Technisches Handbuch des Hausbrandes (Technical Handbook of Domestic Heating), by Ing. W. Hausler, 1950. Gift of the author.

The presentation of textbooks and pamphlets in the field of heating, ventilating, and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

Albert Buenger

BUENGER APPOINTED TO ENGINEERING POST

Albert Buenger has been appointed assistant supervising engineer for the Sheraton Corporation of America, it was announced by Mark Schmidt, general manager of the Hotel Sheraton-Gibson and Hotel Sinton. Mr. Buenger will be in charge of the chain's western hotels, including its three in Cincinnati and others in Chicago, St. Louis and Pittsburgh.

Former building superintendent for the Hotel Gibson Corp., Mr. Buenger will retain his present headquarters at the Sheraton-Gibson and will continue his duties as building superintendent of the Sheraton-Gibson, Sinton and Alms.

A member of the Society since 1917, Mr. Buenger served on the Council from 1934-37 and on many Committees. In 1943 he served as president of the Cincinnati Chapter.

ASTM MEETINGS

Announcement has been made of the national meetings of the *American Society for Testing Materials* for 1951 and 1952 as follows: 1951—*ASTM* Spring Meeting and Committee Week, Cincinnati, Ohio, March 5 to 9, *ASTM* Annual Meeting, Atlantic City, N. J., June 18 to 22; 1952—*ASTM* Spring Meeting and Committee Week, Cleveland, Ohio, March 3 to 7, *ASTM* Annual Meeting, New York, N. Y., June 23 to 27.

OBITUARY

WILLIAM FREDERICK GRAHAM

Toronto, Ontario, Canada

The death of William Frederick Graham occurred on August 8, 1950. Mr. Graham was born on July 14, 1888 in Toronto and attended school there.

From 1921 until 1930 Mr. Graham was associated with Gurney Foundry Co., Ltd., as designer of hot water and steam heating boilers and radiators. He then joined the staff of Factory Equipment, Ltd., Toronto, as an estimator of boiler and pipe covering contracts. In 1934 he began designing hot water boilers for Imperial Iron Corp., Ltd., and in 1937 began designing hot water and steam systems for the same company. Mr. Graham became manager of the heating department of James Robertson Co., Ltd., of Toronto, in August 1949, which position he held until the time of his death. He became a member of the Society in 1946 and was a Past Master of the Temple of Masonic Lodge. Mr. Graham is survived by his wife and a son, William.

IN MEMORIAM

WILLIAM H. DRISCOLL

1879-1950

THE MANY friends of William H. Driscoll, past president and Life Member of the Society, received the sad news of his sudden passing on September 6, in his 72nd year. Mr. Driscoll was vice president of the Carrier Corp., Syracuse, N. Y., and had recently been engaged in supervising the construction of a new plant for the company, having deferred his retirement for this project.

Mr. Driscoll was born in Jersey City, N. J., August 14, 1879, and received his early education in the public schools of that city. After graduating from high school he joined the A. A. Griffing Iron Co. of Jersey City as a clerk (1896-1897). He then spent two years with the Standard Steam Specialty Co. in clerical and sales work. In November 1899 he became a salesman for Frank C. McLain Co. and in February 1901 he joined John B. Clarke as a draftsman and later became superintendent of construction for John B. Clarke's Son, all in New York City.

Mr. Driscoll was determined to become an engineer and for a period of 12 years he attended night classes at Cooper Union, Columbia University and Pratt Institute. Previously he had attended New York Trade School and Mechanics Institute.

In 1910 he joined the Thompson-Starrett Co., Inc., and remained there for 27 years and when he left the company, he was vice president and a member of the board of directors. During his association with the company he was in charge of the installation of mechanical equipment, including heating, ventilating, air conditioning, and electrical work. He was intimately connected with the work of skyscraper construction during the period of development of this type of building. Among those with which he had close connection in New York were, the new Waldorf Astoria Hotel, Bank of Manhattan, Equitable and Woolworth Buildings, and many of the skyscrapers in Philadelphia, Pittsburgh, Cincinnati, Detroit, Chicago, St. Louis, and other cities.

Mr. Driscoll joined the Carrier Corp., Syracuse, N.Y., in 1937 as vice president in charge of construction and was with the company until the time of his death.

He joined the Society in 1904 and during the more than 45 years of his membership he was personally known to thousands of its members. He had the rare privilege of association with the Society's founders, who were the pioneers in the practice of heating, ventilating, and air conditioning, as well as intimate contacts with men who are carrying on work in the field today. He was a man of great enthusiasm and energy and he brought to the Society his great organizing talent, as well as a great interest in its advancement. He played a leading role in many of the Society's most notable undertakings, such as the establishment of the Research Laboratory, the founding of the JOURNAL and THE GUIDE, and assisted in establishing a sound financial basis for Society operations.

Mr. Driscoll had a remarkable record of service to the Society and actively participated in its work for several decades. He served as president of the Society in 1926 and prior to that time had been first and second vice president and treasurer, and was a member of Council from 1918-1927, and served as chairman of the Committee on Research in 1924 and 1925. Among the numerous committee assignments were the following:

1917-24	Code for Testing Low Pressure Heating Boilers
1917-20	To Confer with *National District Heating Association* (chairman in 1919 and 1920)
	To Cooperate with U.S. Navy Dept.
1920-22	To Confer with *ASME* Boiler Code Committee on Heating Boilers
1920-24	Steam and Return Main Sizes
1920-25	Executive Committee of Council
1921	Membership Committee
1922-23	Finance Committee (chairman in 1922)
	Guide Publication Committee (chairman in 1927)
1925	Sub-Committee of Committee on Research on Ventilation
1926-27	Member of Committee on Research (chairman in 1924 and 1925)
1927	Member of Finance Committee
1928	Revision of Constitution and By-Laws (chairman)
1930	Code of Minimum Requirements for Heating and Ventilation of Buildings
1932-35	Special Committee on Ventilation Standards (chairman)
1932-34	Code for Testing and Rating Condensation and Vacuum Pumps
1933-42	TAC on Corrosion
1933	Special Committee on Nomenclature
1936-43	TAC on Heating and Cooling Requirements of Buildings
1940-41	Special Committee to Study Method of Selecting Society Officers and Council
1943-44	Committee on War Service
1946	F. Paul Anderson Award
1947	Special Society History Committee
1948	Honorary Chairman of Committee on Arrangements for 1948 Annual Meeting in New York
1950	Research Plan Committee

Mr. Driscoll will be remembered as one of the Society's immortals for his devoted and unselfish service to its ideals and its advancement. He was one of the Society's builders and his ideals and leadership were an inspiration to many of his fellow members who will cherish the memory of his work and his wisdom. His name is indelibly inscribed on the rolls of the Society. In addition to his work for the Society he served for many years on the Board of Directors of the *Heating, Piping and Air Conditioning Contractors National Association.* He was active in the Knights of Columbus, was a member of the Holy Name Society of St. Aedan's Roman Catholic Church, and was a Life Member of the Society of the Friendly Sons of St. Patrick in the City of New York.

Surviving Mr. Driscoll are his wife, the former Mary L. Heffernan; two daughters, Elizabeth (Mrs. John Sherry) and Mary (Mrs. C. W. Miller); three sisters, Mrs. Mary Donnelly, Miss Jane Driscoll, and Mrs. Gertrude Marum; and three brothers, David, Martin and Daniel Driscoll to whom the members, the Officers, and the Council extend their profound sorrow.

A Solemn High Mass was offered in St. Aedan's Church at 10:00 a.m. on Saturday, September 9, and interment was in Holy Name Cemetery in Jersey City.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Headquarters: 51 Madison Ave., New York 10, N. Y. (Tel. Murray Hill 3 0291)

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Corrosion: L. F. Collins, *Chairman;* A. S. Gates, Jr., A. E. Griffin, E. W. Guernsey, A. J. Hess*, H. A. Pray, F. N. Speller.

Heat Flow Through Glass: R. A. Miller, *Chairman;* A. B. Algren*, W. I. Arner, A. H. Baker, F. L. Bishop, Jr., R. D. Blum, J. E. Frazier, J. S. Herbert, E. R. Koppel, D. R. Muir, F. W. Preston, W. C. Randall, C. A. Richardson, Vic Sanders, H. B. Vincent.

Heat Pump: R. C. Jordan, *Chairman;* E. R. Ambrose, R. D. Blum, C. F. Boester*, F. R. Ellenberger, W. F. Friend, C. F. Kayan, F. N. Kemler, J. D. Kroeker, E. P. Palmatier, E. B. Penrod, S. S. Sanford.

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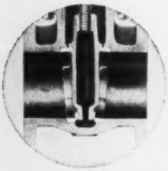

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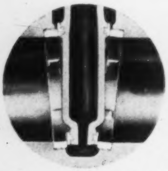

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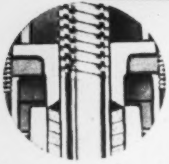

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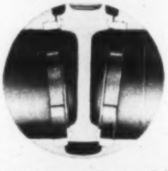

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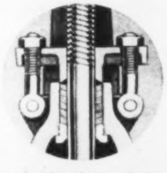

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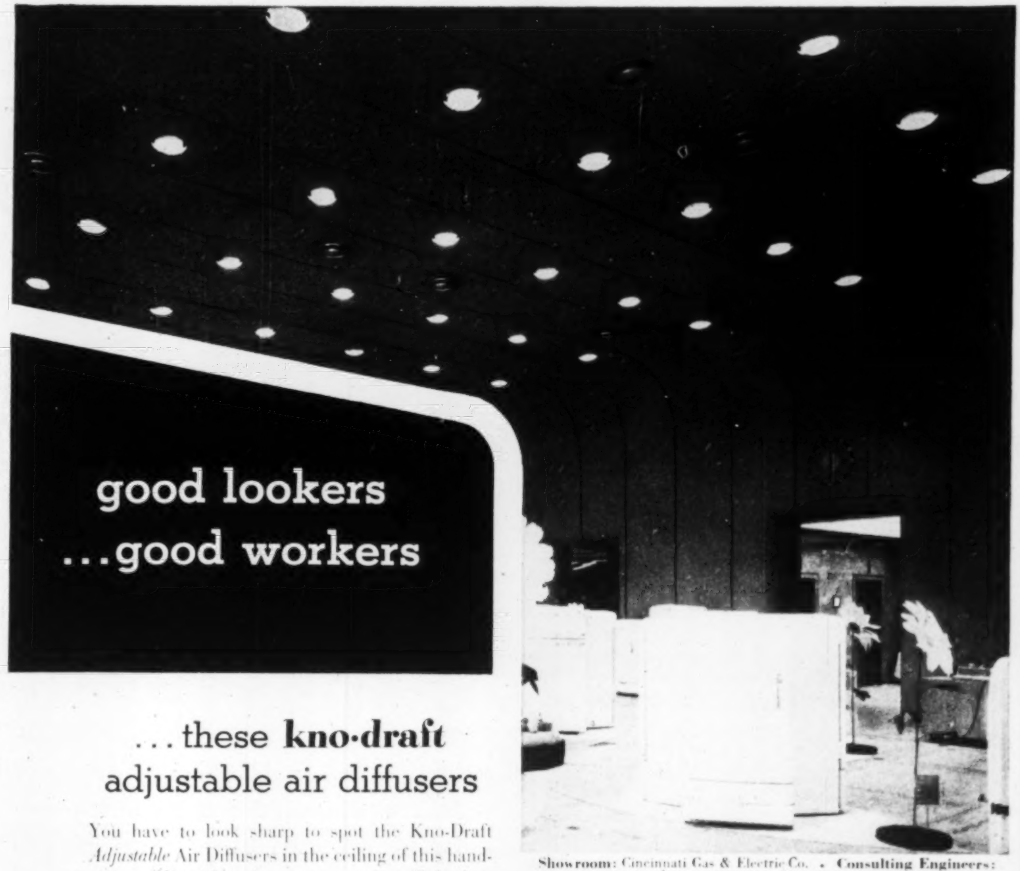

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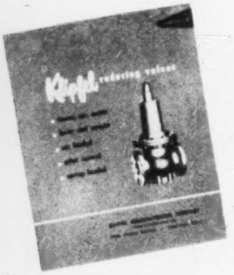
In short, Klipfel engineers have prepared these bulletins to assist you in selecting the type and size valve best suited to your needs.

Write Dept. C-10 for any bulletins you wish. We'll gladly send them to you.

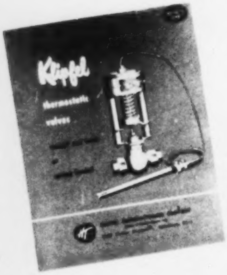


KLIPFEL REDUCING VALVES

for steam, air and water . . . in lever and weight, air loaded, pilot control and spring loaded types; descriptions, illustrations and complete selection data in Bulletin 148.

KLIPFEL FLOAT VALVES

Single and double seated types with direct action or pilot control for remote location. Types shown include quick-acting valves; all are available in angle and globe patterns. Bulletin 349.



KLIPFEL THERMOSTATIC VALVES

vapor pressure operated valves with spring or weight and lever loading. Valves are ball type, balanced cup and disc or balanced inner valves. Min. temp. 80°. Max. temp. 250°. Range limit of any instrument 40°.

Klipfel
back pressure valves

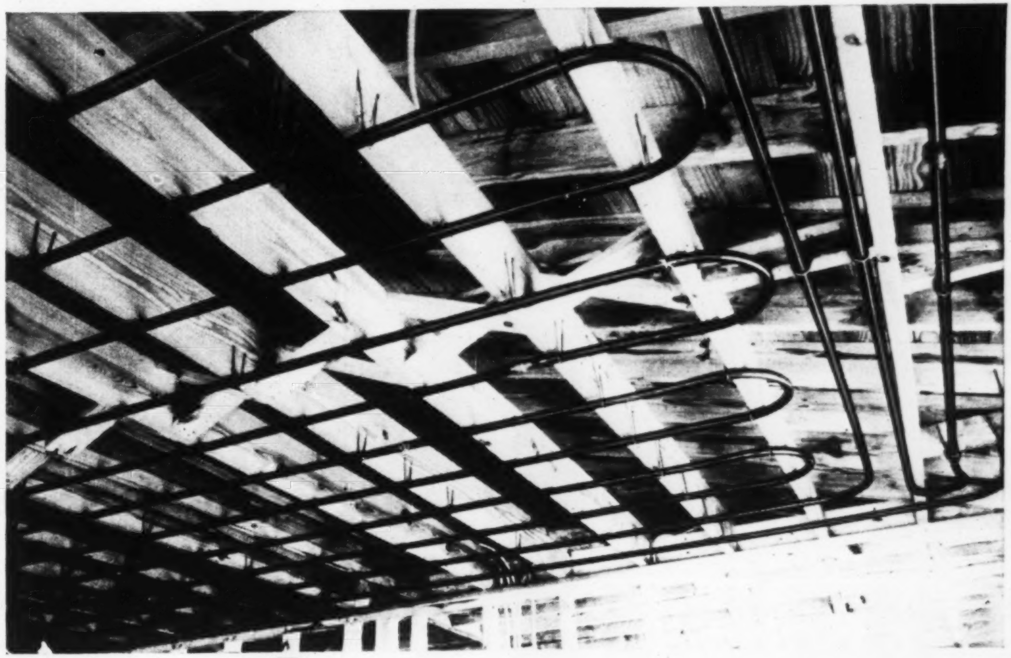
KLIPFEL BACK PRESSURE AND RELIEF VALVES

for control of air, steam and water pressures at the valve inlet in various types for practically any service. Bulletin 648 gives complete details including dimensions and capacities.

HT CORP

Klipfel VALVES INCORPORATED

DIVISION OF HAMILTON - THOMAS CORPORATION, HAMILTON, OHIO



This residential radiant heating ceiling panel, fabricated of Republic Steel Pipe, includes approximately 207 bends. After it had been suspended from ceiling joists and metal lath had been wired to the underside, the entire panel was plastered to form one continuous radiant surface.

Every Bend RIGHT ON THE BEAM

● Republic Steel Pipe rates high for radiant heating.

Made by Republic's own advanced Continuous Weld Process, it is highly ductile, easy to fabricate, especially *suited to close coiling and bending.*

Having an expansion co-efficient equal to that of plaster and concrete, it is perfectly adaptable to ceiling, sidewall or floor radiant panels.

It comes to you in long lengths that speed-up installations by reducing the number of joints. It welds readily by all standard methods.

Republic Steel Pipe adds one more advantage to all these—Economy. You need nothing more costly than steel pipe for closed radiant heating systems. That fact is proved beyond question by the remarkably trouble-free record of steel pipe, standard over the years for all closed heating systems.

What's more, today's improved Republic Continuous Weld Pipe is an even better buy than that which began to serve you so well twenty years ago.

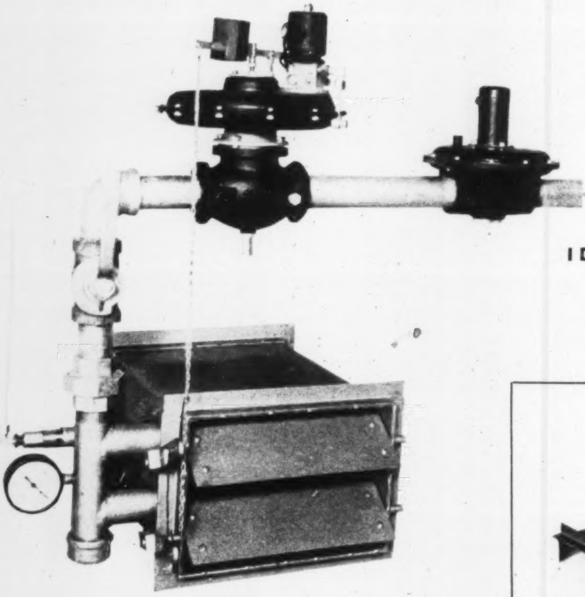
Your Republic Pipe Distributor will be glad to give you more facts, including latest information on available sizes and current delivery schedules. See him soon.

REPUBLIC CONTINUOUS WELD PIPE

- Uniformly Strong
- Uniformly Ductile
- Uniformly Clean and Scale Free
- Easy to Weld by All Modern Methods
- Easy to Bend, Thread and Close Coil
- Economical Uniform Lengths, Extra Long Lengths
- Uniform Wall Thickness, Diameter, Concentricity
- Expansion Co-efficient Same as Concrete and Plaster

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • • CLEVELAND 1, OHIO
Export Dept : Chrysler Building, New York 17, New York

Republic
REPUBLIC STEEL®
STEEL PIPE
IS FIRST CHOICE

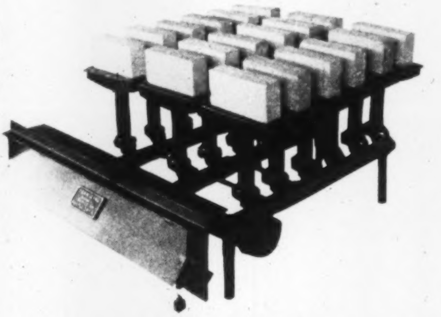


The New John Zink SERIES STV GAS BURNER

IDEAL FOR HEATING BOILER INSTALLATIONS

—From 1 to 50 Heads—

QUIET - EFFICIENT - ECONOMICAL



JOHN ZINK
— Series VR —
GAS BURNER

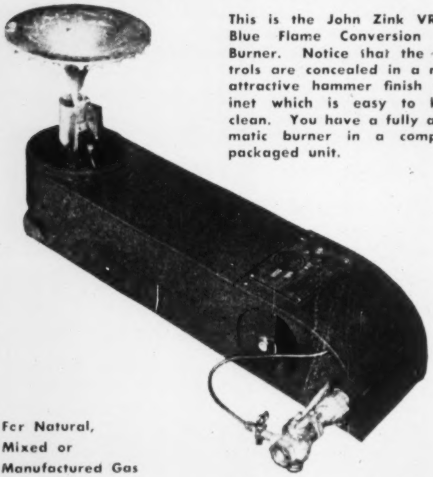
This burner operates with high efficiency at either low or high capacities on low gas pressures. Heat release is increased 20% to 40%. At four ounces natural gas pressure it gives 325,000 B.T.U./sq. ft. of burner area. Multiple burner heads can be arranged to fit any firebox; provision is made for standard size firebrick baffles. Burner is furnished with a blowout proof pilot, either with or without flame failure feature.

VR Burners are especially designed for boilers having low draft and small combustion space.

IDEAL for COMPLETE AUTOMATIC CONTROL APPLICATION

— BLUE FLAME — CONVERSION BURNER

This is the John Zink VR 20 Blue Flame Conversion Gas Burner. Notice that the controls are concealed in a neat, attractive hammer finish cabinet which is easy to keep clean. You have a fully automatic burner in a complete packaged unit.

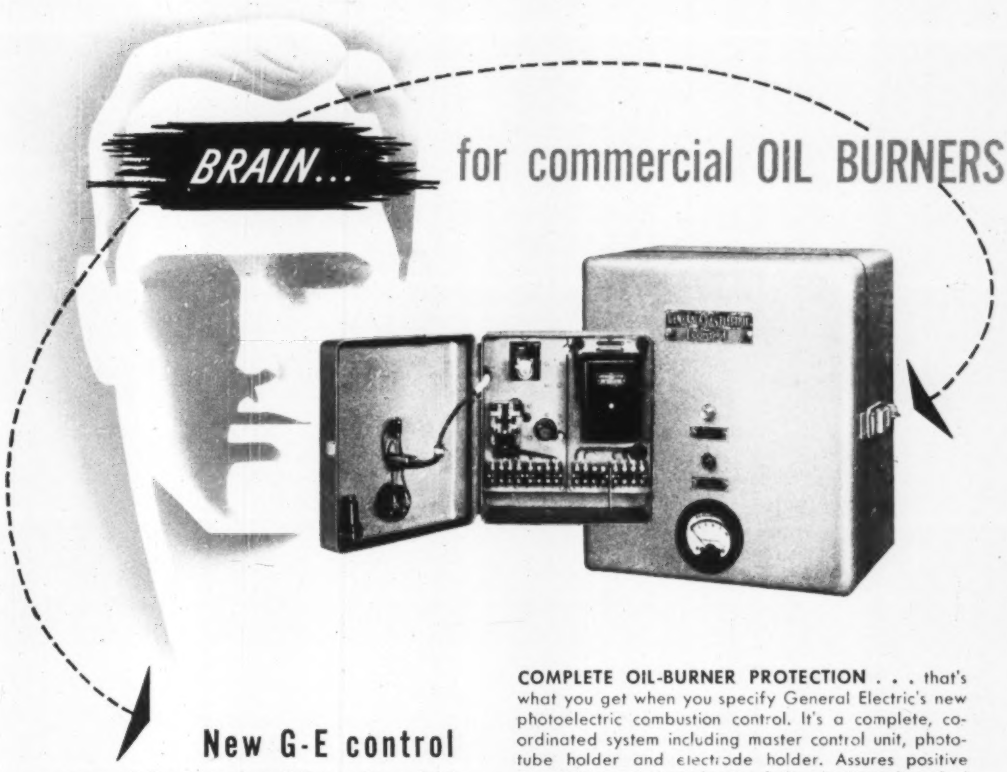


For Natural,
Mixed or
Manufactured Gas

WRITE FOR LITERATURE

JOHN ZINK COMPANY

4401 SOUTH PEORIA **TULSA, OKLAHOMA**



BRAIN... for commercial OIL BURNERS

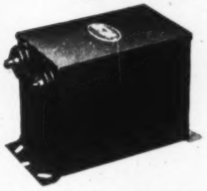
New G-E control provides "double-check" protection against:

PILOT FAILURE
FLAME FAILURE
POWER FAILURE
CARBONIZING
COLD-OIL STARTING

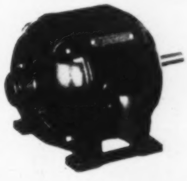
COMPLETE OIL-BURNER PROTECTION . . . that's what you get when you specify General Electric's new photoelectric combustion control. It's a complete, coordinated system including master control unit, phototube holder and electrode holder. Assures positive protection against combustion failure by immediate fuel cut-off. All components of the system are easily removable for inspection and test without disturbing connections. Write for Bulletin GEA-4779: "Electronic Combustion Control for Commercial Oil Burners."

Development of this device is yet another proof that General Electric keeps abreast of commercial-burner needs with dependable electric equipment—including ignition transformers, motors and control. When you order oil burners, ask for complete electric equipment by General Electric. *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

EQUIPMENT FOR COMMERCIAL BURNERS



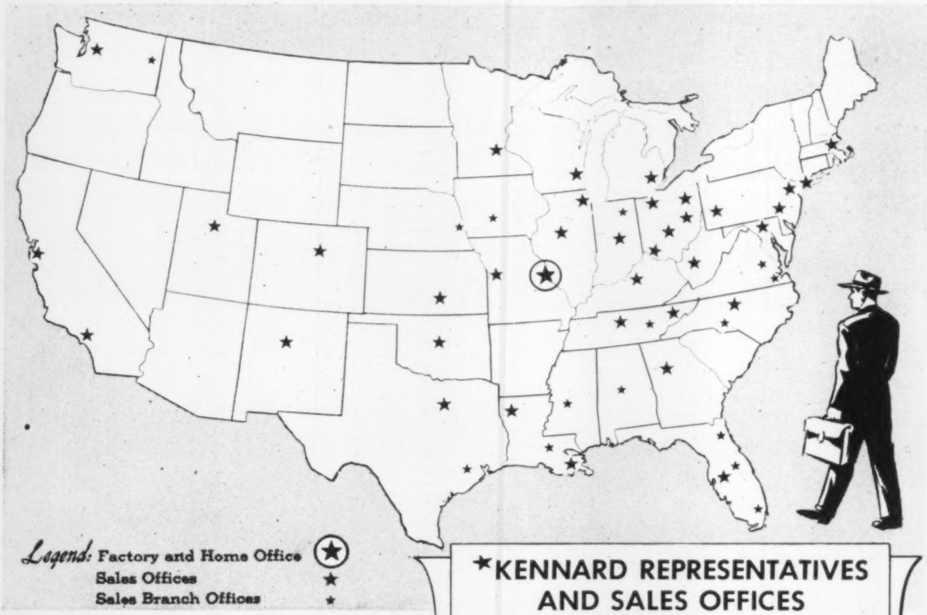
IGNITION TRANSFORMERS



MOTORS

CONTROL

GENERAL ELECTRIC



★KENNARD REPRESENTATIVES AND SALES OFFICES

Consult Our *Experienced* Heat Transfer Representative IN YOUR VICINITY

KENNARD *Engineered* **Service Keeps Pace**

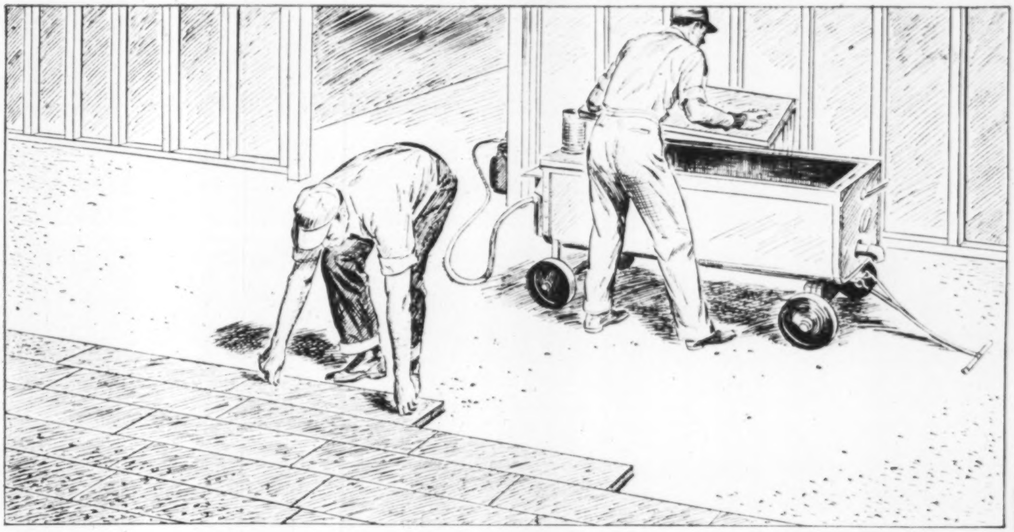
The growing acceptance of KENNARD Engineered Products has resulted in a large, competent sales and service organization covering the nation—*as close as YOUR telephone.*

This ready availability of information and engineering services is another important plus factor for choosing KENNARD Heat Transfer Equipment. It means you have experienced engineers *near at hand* to help you design your layout and select equipment best suited to YOUR needs.

We invite you to consult the KENNARD representative in your district. If you do not know him, write us for his name and address. He knows Heat Transfer Equipment. He will gladly explain the many superiorities of the KENNARD line—the quality line with ALL of these advantages—Penta-Post frame construction; non-corrosive metal screws, nuts, bolts and washers; solid bronze latches; non-corrosive coil frames and 3000 psi hydraulically expanded *scale-free* coils.

"Refinement of Detail Marks the Difference Between Ordinary and Excellent"

KENNARD CORPORATION • **1817 S. HANLEY ROAD**
ST. LOUIS 17, MISSOURI



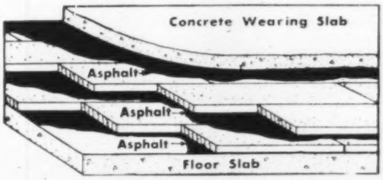
What's wrong with this picture?

These men are making a mistake that could cause a great deal of needless expense and trouble. In insulating the floor of a cold room, they're just dipping the corkboard in hot asphalt then applying it directly to the concrete floor. For a good job, a heavy flood or mop coat of hot asphalt should be applied to the floor first.

Merely dipping the board is not sufficient for two reasons. First, any irregularities in the corners or edges of the cork will mean a break in the asphalt seal. A good heavy flood or mop coat, on the other hand, assures a solid vapor barrier across the entire subfloor surface. Second, a dip coat is not heavy enough to fill any irregularities or hollows in the concrete surface. Air pockets are left under the insulation where frost and moisture may collect. A little moisture probably won't cause much trouble. However, once a small amount of moisture accumulates, more is almost sure to follow, and when it freezes it expands, causing the insulation and the concrete wearing floor to buckle. Flooding the floor with asphalt fills the voids and keeps out moisture.

The extra cost of the asphalt required to do the job properly is trivial. Practical experience has taught Armstrong engineers that the right way is always less expensive in the long run.

In almost 50 years in the insulation business, the entire Armstrong organization has learned how to design and build low-temperature construction that can be expected to give long and trouble-free service. The next time you have an insulation job, take advantage of this knowledge. In addition to qualified engineering advice, the Armstrong contracting organization offers you corkboard insulation, the standard of comparison in the low-temperature field, and trained mechanics to apply it. Call the Armstrong office nearest you or write directly to Armstrong Cork Company, 4410 Concord St., Lancaster, Penna.



ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2800° F.

For ductwork that pays dividends—

U·S·S Galvanized Sheets

UNIFORM in softness, flatness and surface, U·S·S Galvanized Steel Sheets possess the *right* characteristics for good-looking, long-lasting ductwork.

Their tightly-adhering and uniform coating of zinc assures maximum durability. And when ducts are fabricated from material of this quality it is easy to obtain tight, neat connections with soldered, cemented, or riveted joints.

Most jobbers carry and recommend U·S·S Galvanized Steel Sheets. But to be sure that the work your shop turns out gets the extra protection these superior sheets afford, specify them by name when you place an order.

To stand up under severe atmospheric conditions

U·S·S GALVANIZED COPPER STEEL SHEETS

—give twice the atmospheric corrosion resistance at little or no additional cost!

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TRADE MARK

GALVANIZED STEEL SHEETS

UNITED STATES STEEL

The Importance of the Revolving Discharge Outlet in the Heating of Industrial Buildings

by D. Gilbert

The almost universal use of unit heaters for industrial plant heating indicates a conviction on the part of plant engineers, managers, consulting engineers and architects that this is the most satisfactory way of heating buildings and work rooms. Industry has come a long way, indeed, from the days not too long ago, when pipe coils, suspended from side walls or under windows, were the common means of heating a plant.

But, as pointed out in the article on Unit Heaters in a leading authoritative publication:

"In order to direct the air to points desired, and to diffuse the air to avoid drafts, unit heaters are commonly equipped with directional outlets, adjustable louvers, or fixed types of diffusers. . . . As hot blasts of air in the working zone are usually objectionable, heaters mounted on the floor should have their discharge outlets above the head line, and suspended heaters should be placed in such manner and turned in such direction that the heated air stream will not be objectionable in the working zone."

This is sound advice, but even with such stratagems, it is seldom possible to obtain satisfactory results. The basic difficulty lies in the use of *stationary* discharge outlets. Only one type of unit heater is able to avoid the objectionable "hot blasts" so distressing to workers in fixed positions, as on assembly lines or at machine tools. That is the heater suspended from roof or ceiling in which the downward discharge of heated air is distributed by slowly *revolving* discharge outlets. There are no fixed blasts, no chilly corners untouched by the air streams; just a gentle, thorough movement of the heated air at the working level, over obstacles, around obstructions, moving under tables, benches, truck bodies, airplane wings, even into repair pits. The result is an evenly warmed blanket of air at the working level, a gently moving, invigorating atmosphere that is pleasantly stimulating to the worker and better for his health.

WINGS for the Aviation Industry

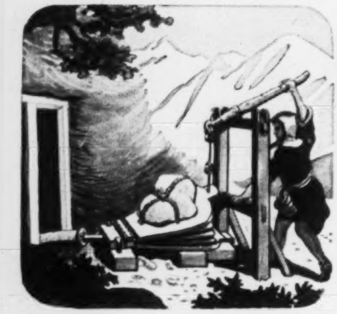
WING Revolving Unit Heaters solve a trying problem in the heating of hangars and manufacturing areas—the obstruction offered to heat distribution by the large surfaces of wings and fuselages. The revolving discharge outlets *flood* the entire working area with a blanket of fresh, live, healthfully warmed air, moving over obstructions, under wings and plane bodies, thoroughly and evenly heating remote corners and galleries. There is a Wing Revolving Heater for *your* type of plant, too. Write for publication HR-5.

The Wing Revolving Discharge Outlets turn slowly through a complete circle about once every two minutes.

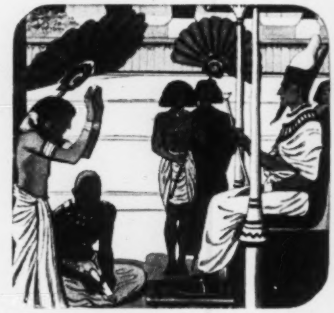
L. J. Wing Mfg. Co.
140 Vreeland Mills Road
Linden, N. J.
Canadian Factory: Montreal

Wing

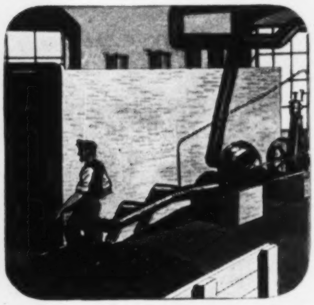
Revolving
UNIT HEATERS



1 **1561**—A crude, manually operated bellows like this was used in an attempt to pump fresh air into a mine in Switzerland. And man's quest for comfort, by putting air to work, was under way.

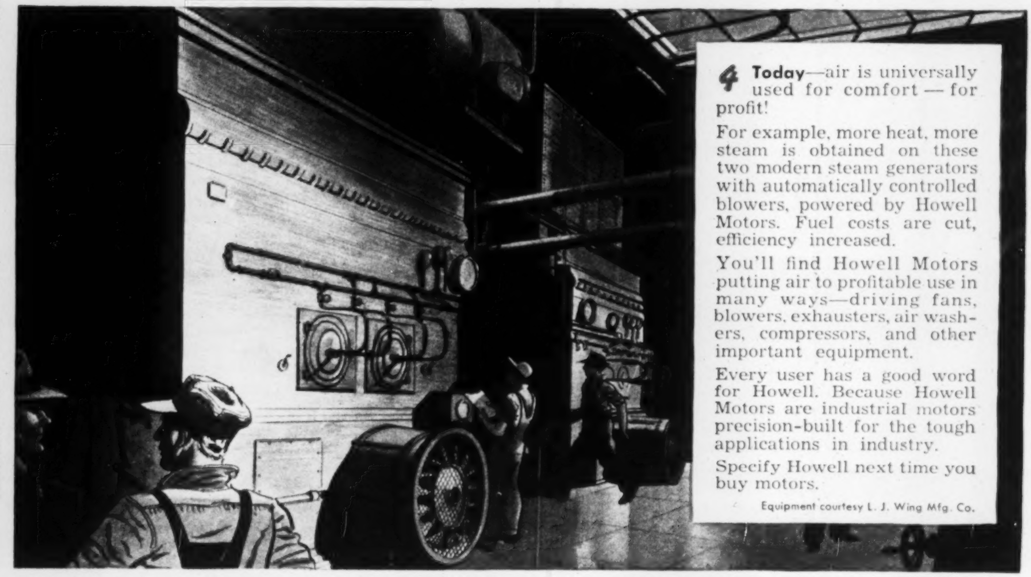


2 **1700**—This age-old method of moving air for its cooling effect was used in many parts of the world. Needed was a form of low-cost power that would move air mechanically, automatically, and efficiently.



3 **1873**—This steam-operated, forced draft fan promoted efficient burning of fuel in boilers. By 1915, Howell Electric Motors arrived. The era of electrical power put the handling of air on a paying basis.

NOW... AIR IS PUT TO PROFITABLE USE!



4 **Today**—air is universally used for comfort — for profit!

For example, more heat, more steam is obtained on these two modern steam generators with automatically controlled blowers, powered by Howell Motors. Fuel costs are cut, efficiency increased.

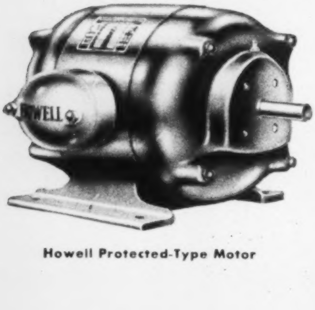
You'll find Howell Motors putting air to profitable use in many ways—driving fans, blowers, exhausters, air washers, compressors, and other important equipment.

Every user has a good word for Howell. Because Howell Motors are industrial motors precision-built for the tough applications in industry.

Specify Howell next time you buy motors.

Equipment courtesy L. J. Wing Mfg. Co.

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.



Howell Protected-Type Motor

HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

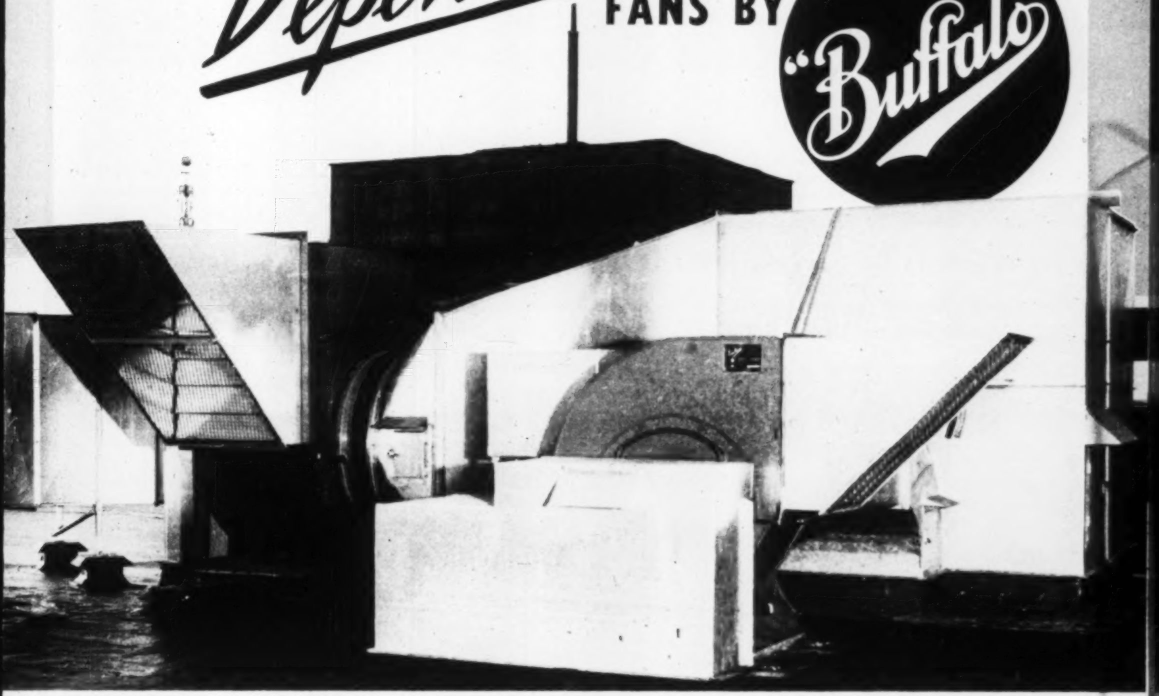
Precision-built Industrial Motors Since 1915

HOWELL
Red Band
MOTORS

PICK THE FANS

SO MANY BIG BUILDINGS

Depend On FANS BY "Buffalo"



Ventilating Telephone Building

The roof installation of "Buffalo" Fans shown above is efficiently exhausting stale air from the new 13-story building of the Pacific Telephone & Telegraph Building, Los Angeles. In thousands of the country's largest ventilating and air conditioning jobs, "Buffalo" is the choice.

One User of "Buffalo" Fans Says —

"We use your blowers in our plant for dust collecting, ventilating and material handling from our grinders. We find them very economical and highly satisfactory."

This user (name on request) is just one of many who take time to report to us the good performance of their "Buffalo" fans and air conditioning units.

Let Us Solve YOUR Air Problems!

The "Buffalo" organization offers you a complete line of job-proven fans and air conditioning units — plus seventy-two years of "air know-how" — to assure you complete satisfaction in any air handling application. Write us about *your* air problem!

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

171 MORTIMER ST. BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT **AIR WASHING COOLING** **AIR TEMPERING HEATING** **INDUCED DRAFT** **EXHAUSTING PRESSURE BLOWING**

"Installation time cut in half with ELECTROMAZE!"

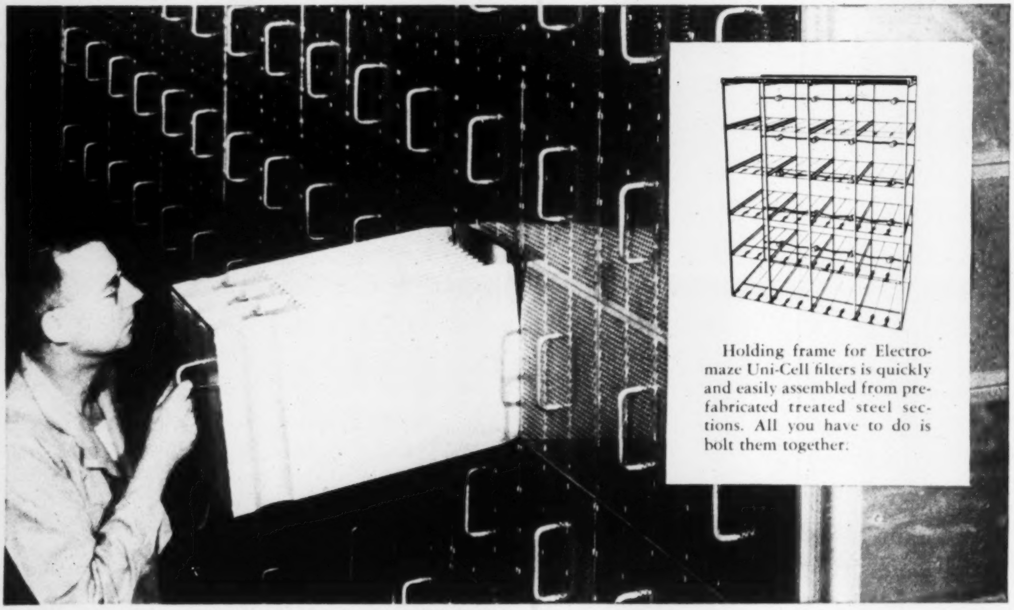
says MR. DION MANNEN, PRESIDENT OF MANNEN AND ROTH, CLEVELAND, OHIO

"We've had experience with all types of electronic precipitators and from the standpoint of erection and installation, Electromaze just can't be beat", reports Mr. Dion Mannen, well known Cleveland, Ohio, contractor. "Compared with other electronic filter systems, Electromaze requires 50% less time and effort to install. Our workmen are enthusiastic, too, because Electromaze installation jobs are so simple."

This is typical of comments received from leading heating and ventilating contractors from coast to coast.

Electromaze filter banks can be erected faster and more economically than any other type because the cellular steel holding frames reach you in pre-fabricated sections. All you have to do is bolt the sections together. Light, easily handled Electromaze Uni-Cells slide into the holding frames to complete the bank.

Electromaze, designed by Air-Maze, *the filter engineers,* is a new kind of electrostatic dirt precipitator made up of individual cells that slide in and out like filing cabinet drawers. This revolutionary design makes Electromaze easier and faster to clean. Three sizes of Electromaze Uni-Cells are available and can be combined to meet almost any space or capacity requirement. Other features include dual ionization wires, all-aluminum plate construction and self-adjusting power supply. For complete information, contact your nearest Air-Maze representative or write to Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.



Holding frame for Electromaze Uni-Cell filters is quickly and easily assembled from prefabricated treated steel sections. All you have to do is bolt them together.

Here's a typical Electromaze installation showing the convenient "file drawer" construction.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE
THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

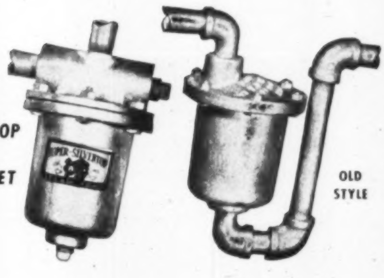
IF your steam trap buckets act like this . . . SWITCH to

SUPER-SILVERTOPS with GUIDED BUCKETS!

If the buckets in your steam traps wobble like an old car, it will pay you to switch to Super-Silvertops. Super-Silvertop Steam Traps are the only traps that have a guided bucket which prevents sloppy bucket action. A guided tube positively controls the bucket, eliminating bucket swing which causes bucket damage and leads to high replacement costs. In addition the exclusive Super-Silvertop bucket lever assures positive seating . . . preventing costly leakage of live steam. This bucket lever also fastens off-center, thereby increasing leverage available for creating greater valve opening power and capacities. Only Super-Silvertops give you these cost-cutting advantages. These features, plus instructive information on the sizing of steam traps for many installations, are discussed in Anderson's famous booklet "Solving Steam Trap Problems". Write for your copy today.

Bucket is guided by this center tube

THE V. D. ANDERSON COMPANY
1994 West 96th Street • Cleveland 2, Ohio



THE V. D. ANDERSON COMPANY, 1949 W. 96th St., Cleveland 2, Ohio

Gentlemen: Please send me a copy of the booklet, "Solving Steam Trap Problems."

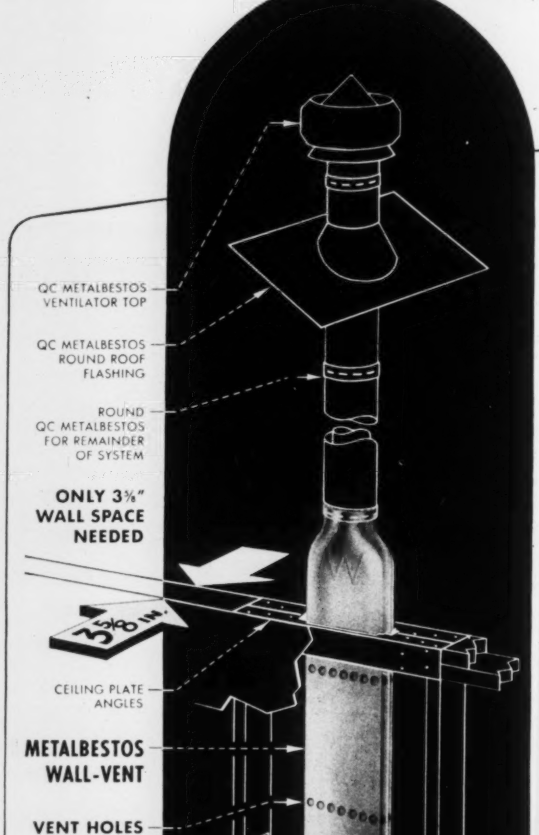
Name

Address

City *State*

In Canada: Bawden Machine Co., Toronto

WALL HEATER VENTING now **SAFE** even with combustible walls!


QC METALBESTOS VENTILATOR TOP
QC METALBESTOS ROUND ROOF FLASHING
ROUND QC METALBESTOS FOR REMAINDER OF SYSTEM
ONLY 3⅝" WALL SPACE NEEDED
3⅝ IN.
CEILING PLATE ANGLES
METALBESTOS WALL-VENT
VENT HOLES FOR AIR CIRCULATION
WALL HEATER

NEW QC METALBESTOS WALL-VENT permits use within ⅜ inch from combustible material.

COOL WALLS AND PROPER VENTING of wall heaters—positive safety even in pine board walls with unfurred 2" x 4" studding—are provided by the new QC METALBESTOS WALL-VENT.

UNDERWRITERS' LABORATORIES, INC. list QC *METALBESTOS WALL-VENT* as a Type B gas vent—and add an additional provision permitting it to be installed with **⅜ inch** clearance from combustible material. No other gas vent pipe has a similar listing.

LISTED UNDER REEXAMINATION SERVICE
UL
UNDERWRITERS' LABORATORIES, INC.

QC METALBESTOS WALL-VENT saves the expense of thicker studding, furring or metal sheathing previously necessary. Extensive tests have proved that this new unit keeps adjacent wall surfaces even cooler than the former Metalbestos wall heater vent pipe.

Write today to Department **N**
for complete information on QC METALBESTOS WALL-VENT and QC METALBESTOS round pipe and fittings.

WILLIAM WALLACE CO.
BELMONT · CALIFORNIA

This is test laboratory Number 39!

It could be right in your own neighborhood . . . one of the typical American homes in which Bryant has a test installation. Or, perhaps there's a store or factory in your city where Bryant commercial-industrial heating equipment is undergoing special tests.

These test applications have helped us to make equipment that is installed easier and faster, more efficient and more economical in operation, requires less servicing. Through them, we have developed improvements that make it more profitable for you to *specify* and your clients to *approve* Bryant automatic gas heating.

There's a Bryant distributor near you, too, with warehouse stock which includes most everything in gas heating, from water heaters to boilers, from unit heaters to air dryers. There's engineering aid if you desire it . . . helpful recommendations planned at Bryant headquarters by the largest staff of experts in the gas heating industry.

Yes, Bryant meets the test . . . in proved equipment, in public preference, in working with your field. It's our conviction that the best contractors deserve the best that we can offer.

Let the pup be furnace man
. . . and water boy, too!

bryant

AUTOMATIC HEATING

The most complete line of gas heating equipment in the nation

Bryant Heater Div., Dept. 158,
Affiliated Gas Equipment, Inc.,
17825 St. Clair, Cleveland, Ohio

( ) Send me the new booklet that tells the Bryant story. ( ) Have your distributor call on me.

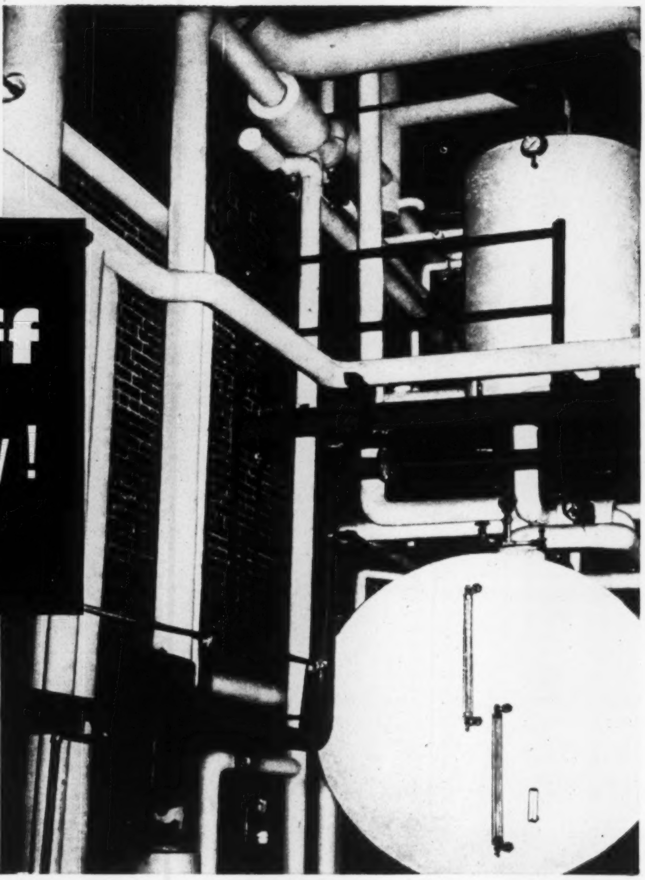
Name______________________________

Company____________________________

Address____________________________

City__________________State__________

Insulation Contractor:
Guy M. Beaty & Co.
Charlotte, N. C.



Hot stuff kept that way!

How United States Plywood Corporation conserves steam — cuts heating costs — with K & M "Featherweight"® 85% Magnesia Insulation

The production of the United States Plywood Corporation's famous *Craftsman's grade* of Weldwood Plywood calls for steam — and plenty of it. In the photo above, you see the Deaerating Feed Water Heater and the Condensate Tank in U.S. Plywood's Orangeburg, S.C., plant. And you can see how K&M "Featherweight" 85% Magnesia Insulation has been applied to these heating units, as well as to the lead lines and pipes of the steam system. Throughout this entire plant, "Featherweight" 85% Magnesia is on the job conserving steam in lines and equipment; keeping heating costs down.

K&M "Featherweight" Insulation has been doing jobs like this for more than 60 years — under every conceivable installation condition. In factories, power plants, oil refineries, chemical plants, hospitals, steamships — wherever exacting steam temperatures must be maintained — you'll find "Featherweight" 85% Magnesia.

This highly efficient insulation combines basic carbonate of magnesia with asbestos fibers — is light-weight, strong, fire-proof — time-proved for all steam temperatures up to 600° F. Ask your local Keasbey & Mattison Distributor for complete information; or, write us direct.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

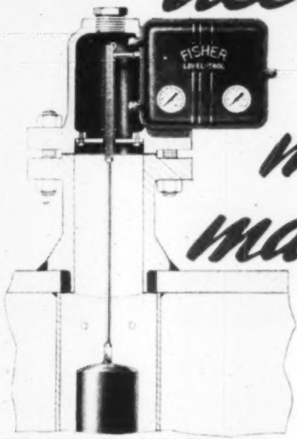
K&M
best in asbestos

6 years of proven field acceptance with minimum maintenance

FISHER® LEVEL-TROL

FISHER
LEVEL-TROL
FLOAT CENTER

TYPE 2405-249
EXTERNAL MOUNTING
LEVEL-TROL



FRONT VIEW SECTIONAL OF TYPE 2405-249P TOP MOUNTING LEVEL-TROL

Fisher Level-Trol is designed for accurate and precise control of all liquids at all specific gravities and temperatures. Available in internal or external mounting constructions for indicating or controlling liquid level.

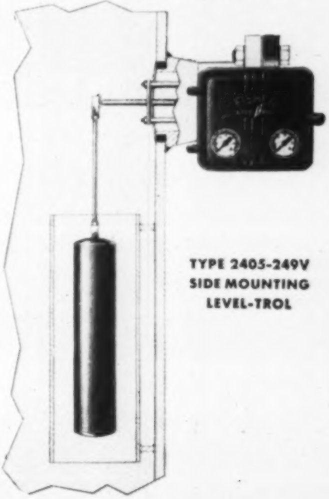
TYPE 2405 LEVEL-TROL PILOT

Features

- Pilot is entirely pneumatic in operation. No intervening links or mechanical joints.
- One control knob with calibrated scale for proportional band and specific gravity adjustment.
- Torque tube can be exchanged or replaced without dismantling entire level controller or breaking into pressure piping.
- High-tensile iron, pressure-tight weatherproof case with hinged gasket sealed cover.
- 8 flanged and screwed mounting connection combinations with 8 standard cage lengths from 14" to 120".

WRITE TODAY FOR BULLETIN F2

FISHER GOVERNOR CO.
MARSHALLTOWN, IOWA



TYPE 2405-249V
SIDE MOUNTING
LEVEL-TROL

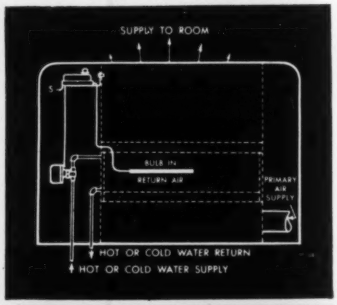
POWERS *Individual Room Control*

Insures MAXIMUM COMFORT

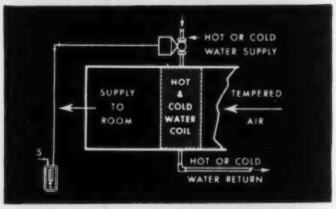
in HOTELS and APARTMENTS

in OFFICES and HOSPITALS

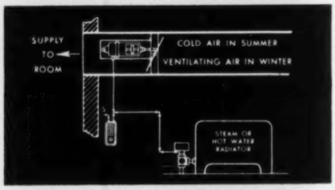
and other types of multi-room buildings

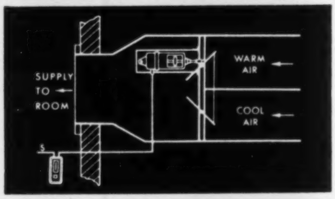

SUPPLY TO ROOM
S
BULB IN RETURN AIR
PRIMARY AIR SUPPLY
HOT OR COLD WATER RETURN
HOT OR COLD WATER SUPPLY

For systems using high pressure primary air in room unit

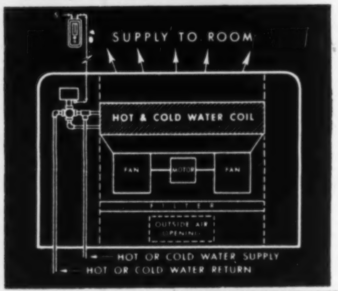

HOT OR COLD WATER SUPPLY
SUPPLY TO ROOM
HOT & COLD WATER COIL
TEMPERED AIR
S
HOT OR COLD WATER RETURN

For systems using individual coil in duct to each room


SUPPLY TO ROOM
COLD AIR IN SUMMER
VENTILATING AIR IN WINTER
S
STEAM OR HOT WATER RADIATOR


SUPPLY TO ROOM
WARM AIR
COOL AIR
S

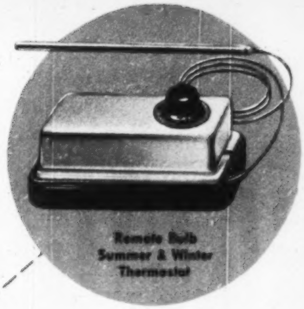
For systems using volume- or mixing damper in duct to each room


S
SUPPLY TO ROOM
HOT & COLD WATER COIL
FAN
MOTOR
FAN
FILTER
OUTSIDE AIR OPENING
HOT OR COLD WATER SUPPLY
HOT OR COLD WATER RETURN

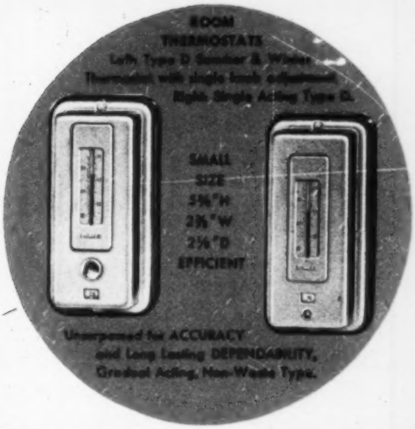
For systems using fan in room unit

For

Air Conditioning



Remote Bulb
Summer & Winter
Thermostat



ROOM
THERMOSTATS
Left: Type D Summer & Winter
Thermostat with single knob adjustment
Right: Single Acting Type D.

SMALL
SIZE
5⅝"H
2⅜"W
2⅛"D
EFFICIENT

Unsurpassed for ACCURACY
and Long Lasting DEPENDABILITY,
Gradual Acting, Non-Waste Type.

Modern Standards of Comfort

. . . demand the many advantages of air conditioning systems with individual room control. To insure the best performance from this type of air conditioning regulate it with a Powers pneumatic system of temperature control.

With the experience gained from installations in many prominent buildings we may be able to help you select the type of control best suited for your requirements. Phone or write our nearest office, there is no obligation.

SAFETY FEATURE

POWERS
NO-PAK
PACKLESS
VALVES

Prevent Damage Caused
by Water Leakage

THE POWERS REGULATOR CO.

Established 1891 • OFFICES IN OVER 50 CITIES • See Your Phone Book

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LOS ANGELES 5, CAL., 1808 West 8th Street • **TORONTO, ONT.**, 195 Spadina Avenue
MEXICO, D. F., Edificio "La Nacional" 601

PNEUMATIC
DIAPHRAGM VALVES

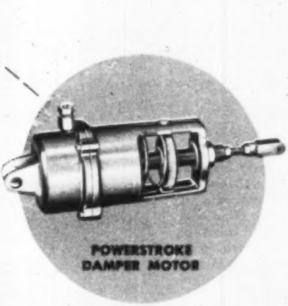
Sectional View of
NO-PAK Construction

- *Double Protection* against loss of vacuum on steam systems or leakage on water systems. Requires no maintenance of packing gland.
- Gives BETTER CONTROL. Eliminates normal packing gland friction. LOW HYSTERESIS.

NO-PAK valves are available with union angle and straightway bodies. Brass packless bellows (A) and Emergency Seat (B) give positive protection against leakage.

Powers Standard Valves are attractive in appearance and ruggedly built to give many years of trouble-free service. They are available with union angle, union straightway or 3-way bodies.

Above: Small, compact pneumatic valve is easy to install on small convectors and other heaters where space is limited. Available with union angle and straightway bodies and standard packing.

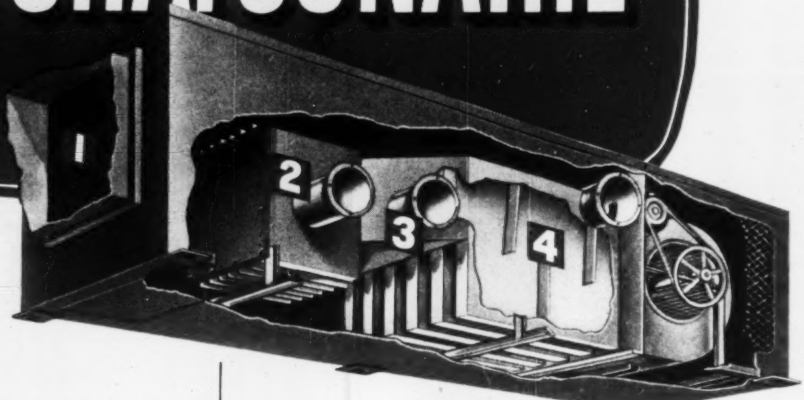


POWERSTROKE
DAMPER MOTOR

Systems

(ACA)

FOUR ESSENTIAL FEATURES found only in SHAFCONAIRE*



SHAFCONAIRE! It's the *original* overhead oil-fired furnace known for years as SHAFCO. And it's the only furnace of its type that has been time-tested, proved-in-use over 12 long years of actual field operation. That's of prime importance to you, too. Because, regardless of a manufacturer's claims and written guarantees, time . . . and time alone . . . offers the only positive proof of the merits of any product. It's your one best assurance of quality, performance, and dependability.

So take a good look at SHAFCONAIRE OVER-HEAD HEATERS. Look under the casing . . . at the all-important inside furnace construction details. See for yourself the exclusive, essential, patented features that have made SHAFCONAIRE the leader of its field, the outstanding quality "buy" on the market today!

1 **BUILT-IN PLENUM CHAMBER**—This exclusive patented SHAFCONAIRE feature saves you plenty of time and trouble in making installations. It's engineered and sized to handle capacity of the furnace. Assures uniformly heated warm air output, improves operating efficiency, reduces installation costs. Eliminates necessity of on-the-job sizing and extra sheet metal work. Ducts may be quickly, easily tapped off from end, top, and both sides to meet installation requirements.

2 **HEAVY DUTY FURNACE**—Use of heavy gauge welded boiler plate construction assures long-life, trouble-free performance. No strains, no warping, no buckling. No burn-outs common to stamped steel fabrication.

3 **INTERMEDIATE HEAT-TRAVEL SECTION**—Patented intermediate chamber between refractory-line firebox and heavy gauge heat exchangers serves to spread flame, permit expansion of hot gases. Effectively prevents impingement of flame on metal, increases life and overall operating efficiency of the furnace.

4 **EFFICIENCY ENGINEERED HEAT EXCHANGER**—Alternately spaced baffle plates in each heat exchanger section effectively retards flow of hot gases toward stack connection, permits maximum transfer of heat through the exchanger.

OverHead Heaters, Inc.

(Formerly SHAFCO Distributing Corporation)

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OverHead Heaters, Inc.
1354 Book Building • Detroit 26, Michigan
Please send me complete information and price lists on your SHAFCONAIRE (formerly SHAFCO) OverHead Heaters.

*Name*________________________
*Address*______________________
*City*__________ *Zone*____ *State*______

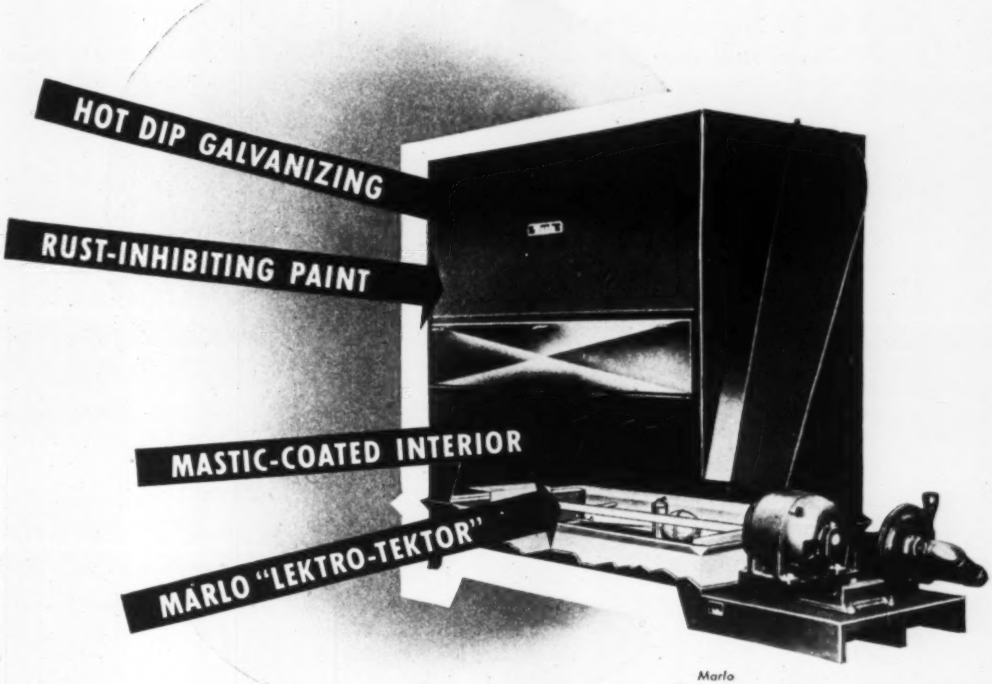
*SHAFCONAIRE, the original overhead furnace formerly known as SHAFCO. Designed, engineered, and built exclusively for commercial and industrial applications. Models from 100,000 to 405,000 B.T.U. Backed by over 12 years actual operation in the field. Send in coupon today for complete details and price information.

Up in the Air
...and out of
the Way

SHAFCONAIRE
OverHead Heaters

ONLY MARLO COOLING UNITS ARE DOUBLY-PROTECTED AGAINST CORROSION

...Outside and Inside



Marlo
Evaporative Condenser

To assure dependable, longer-lasting installations for you — Marlo Evaporative Condensers and Cooling Towers offer this big four-way defense against corrosion:

Outside—over the Hot Dip Galvanizing—Marlo all-steel housings are sprayed with a special rust-inhibiting alkyd resin-base paint that forms an *extra* front line barrier against corrosive elements.

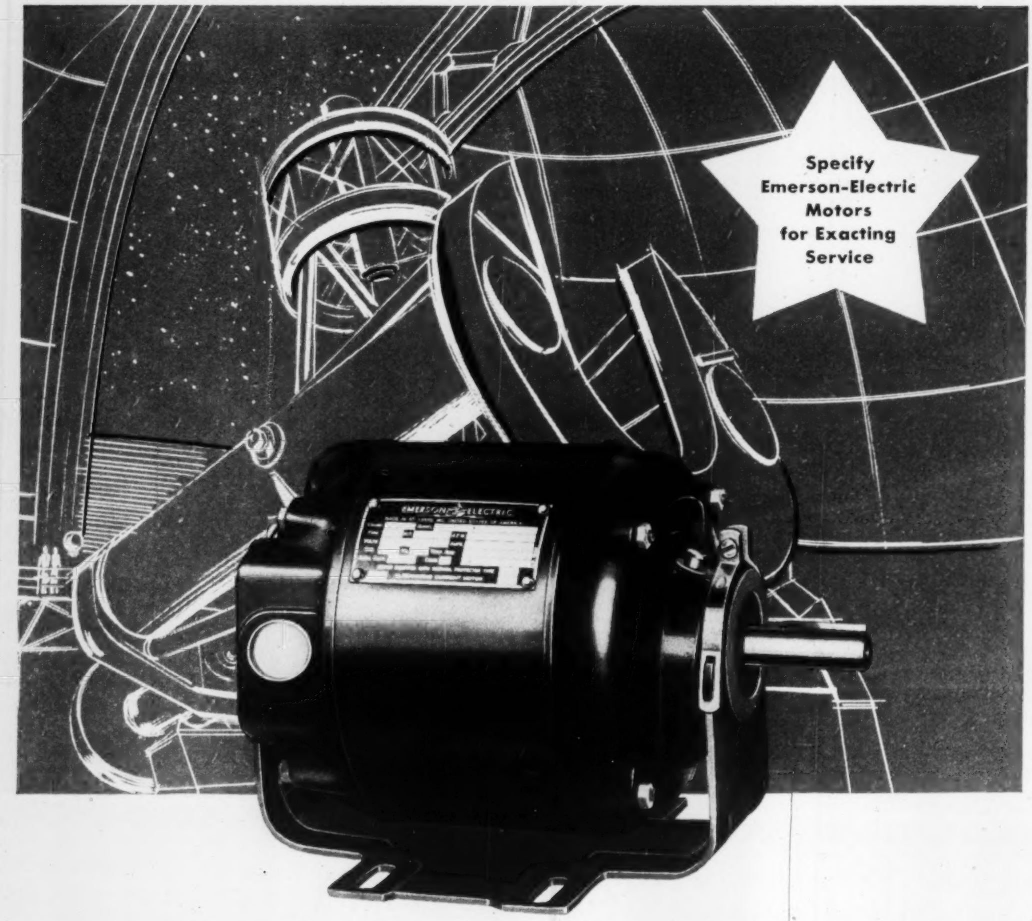
Inside each unit—sheets, panels and galvanized parts are coated with a sound deadening *asbestos-asphalt mastic* that doubles as an efficient corrosion-retardant. Additional internal protection is afforded by Marlo's exclusive "Lekto-Tektor" that *prevents electrolytic sump tank corrosion.*

MARLO = HEAT TRANSFER
Since 1925

25 YEARS CONTINUOUS LEADERSHIP

Write for complete information on Marlo Evaporative Condensers and Cooling Towers.

Marlo COIL CO. • 6135 Manchester Rd. • St. Louis 10, Mo.



Precision Built . . . for Star Performance

Write for these Emerson-Electric Motor Data Bulletins

Appliance and equipment manufacturers, with applications for motors of 1/20 to 5 h.p., can profitably use these authoritative reference guides. Specifications, construction details and performance data are included for the following types:

- ☐ No. 382-A Capacitor-Start Motors
- ☐ No. 382-B Split-Phase Motors
- ☐ No. 382-C Integral Motors
- ☐ No. 382-D Fan-Duty Motors
- ☐ No. 382-E Oil-Burner Motors
- ☐ No. 382-F Jet Pump Motors
- ☐ No. 382-G Blower Motors

You cannot compare the relative differences of the stars with the naked eye. So, too, with competitive products. Externally they may appear similar, yet one far outsells the other because of efficient, long-term performance. The motor you select, can give or deprive your equipment of an important sales advantage.

Knowing that the reputation of its motors is mirrored in the products they power, Emerson-Electric continues its 60-year policy of exhaustive research, scientific design engineering and precision production. Result, scores of America's best known products are Emerson-Electric Motor equipped.

Get the facts. If you have motor requirements in the 1/20 to 5 h.p. range, Emerson-Electric Motors deserve your investigation. Your inquiry is invited.

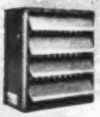
THE EMERSON ELECTRIC MFG. CO.
ST. LOUIS 21, MO.

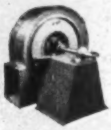
EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

BUILT RIGHT RUN RIGHT

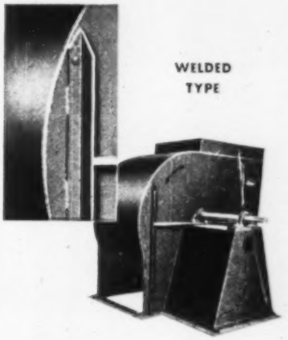
Since 1889

61 *Years of Progress and Development*





nyb



WELDED TYPE

Type ME Fans *Available in Either Welded or Bolted (knocked down)* Construction

nyb Fans Class I and II feature ALL WELDED CONSTRUCTION as standard . . . for simplicity, extra strength and rigidity. They are dust tight, leak proof and desirable where building conditions permit. Welded construction may be had in all classes and sizes of *nyb* fans.

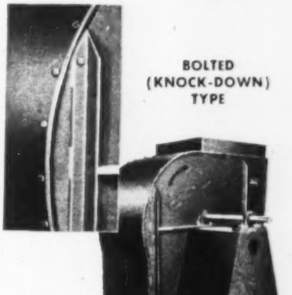
Where building openings will not permit the use of welded fans (shipped set up), bolted (knocked down) type is available.

●

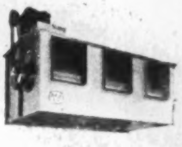
All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

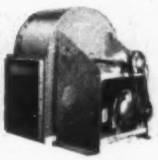
●

Engineering Notes, Bulletin 493 gives full details.



BOLTED (KNOCK-DOWN) TYPE





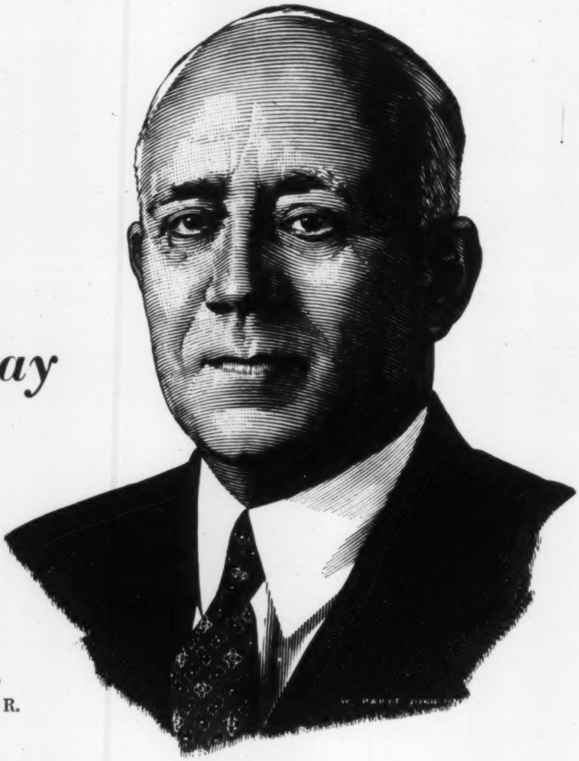
CERTIFIED RATINGS

nyb

THE NEW YORK BLOWER COMPANY

GENERAL OFFICES • 32nd STREET & SHIELDS AVENUE • CHICAGO - 16
FACTORIES AT LAPORTE, INDIANA AND CHICAGO, ILLINOIS

"The easiest way to buy Bonds..."



MR. MARTIN W. CLEMENT,

Chairman of the Board, Pennsylvania R. R.

"The easiest way to buy bonds is through the payroll savings plan. We on the Pennsylvania believe in that plan. Labor and management, officers and employees, over half of us are enjoying it. We believe that it is good for our country, that it is good for our company, and that it is good for ourselves and our families to have these savings."

Top executives of more than 20,000 large companies share Mr. Clement's conviction that the Payroll Savings Plan is good for the country, the company, the employees and their families.

Obviously it is good for the country. The monthly purchase of Savings Bonds by more than 8,000,000 Americans is building a huge fund of buying dollars that will be reflected in the sales curves of tomorrow.

And certainly it is good for the company. The employee who puts a part of his earnings in Savings Bonds *every month* is not the type of man whose name appears frequently on the absentee or accident records. Serious savers are serious—productive workers.

For the employee, the Payroll Savings Plan is a positive boon. It is the easy, automatic way for him to build financial independence, provide for the education of children or save money for a home.

If your company does not have a Payroll Savings Plan, here are two things you can do *today:*

Appoint a Bond Officer, one of your major executives—the kind of man who picks up a ball and runs with it. Tell him to get in touch with the State Director, Savings Bond Division, U. S. Treasury Department. The State Director is ready with a package plan—application cards, promotional material, practical suggestions, and all the personal assistance your Bond Officer may need.

Then make a note on your calendar to check the status of your Payroll Savings Plan six months from today—and you will be surprised and gratified at the high percentage of employee participation you will find.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

HEATING, PIPING & AIR CONDITIONING

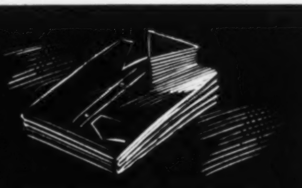
Reprinted from TIME Magazine,
another in a series of messages on the importance of Modern Air Treatment

today's best buy is better air!

Will your new school be obsolete?

There's danger that half the schools being built this year will not be provided with adequate ventilation systems. What a waste! Fresh, clean air makes young minds alert to learning. Individual classroom ventilation is not only economical—it is the only way to make certain of fresh air at constant, automatically controlled temperature. Because only one system offers the highest performance standards ever engineered, your children's schools should have

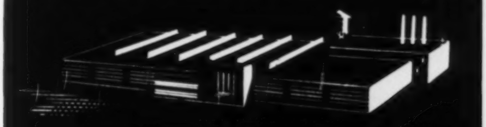
Herman Nelson Unit Ventilation



How many shirts should a store give away? . . .

The men's furnishing department is no place for a dirty shirt! What happens? Shirts soiled by dust in the air sell at ⅓ to ½ off—lose money for the store owner. One great department store says that savings on markdowns alone paid for an American Air Filtering system the first year.

AAF Air Filters and Electronic Precipitators



Industrial "Dust Storms" Must Be Stopped

Dust produced by industrial processes presents a serious handicap to efficient and economical operation. There is hardly an industry, today, that does not employ one or more of the many types of AAF Roto-Clone Dust Control Equipment to protect workmen, materials and machinery. It pays off in good will, good health and great savings.

Roto-Clone and Cycoil

Bad air costs too much! It's expensive! It causes merchandise losses in stores—fatigue in schools—impurities in chemicals—rejects in factories—sleepiness in church. It need not be. In fact, it costs less to get rid of bad air than to suffer its damage.

For you air problem, see how American Air Filter equipment can solve it—and save! (To American Air Filter's facilities have recently been added the ventilating and heating products of the Herman Nelson Division, widely respected in schools, industry and other fields.) When you can see or smell air—when you are air conscious, remember—TODAY'S BEST BUY IS BETTER AIR!

AMERICAN AIR FILTER CO., INC.
AND THE
HERMAN NELSON DIVISION
LOUISVILLE, KENTUCKY · MOLINE, ILLINOIS

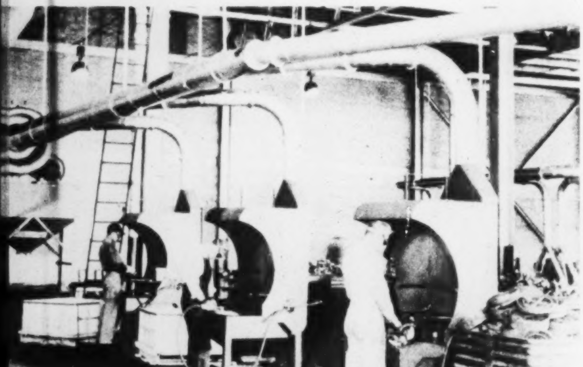
Air Filters • Electronic Precipitators • Roto-Clone Dust Control Equipment • Unit Ventilators • Unit Heaters • Unit Blowers • Propeller and Centrifugal Fans • Portable Heaters and Portable Ventilators

AAF *offers two-way service*

ROTO-CLONES prevent dispersion of process dust

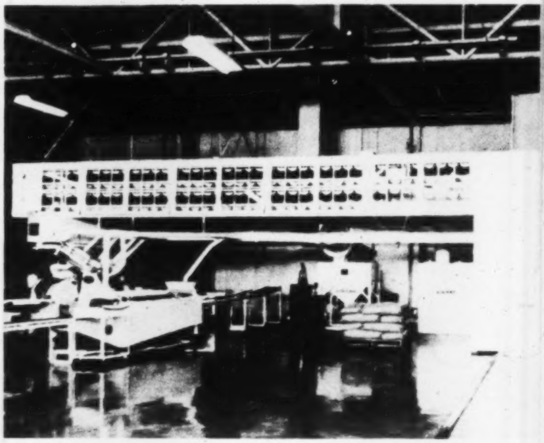
FOUNDRIES

Roto-Clone equipment has spearheaded the clean-up campaign in the foundry industry. Pictured here is a battery of portable grinders which are served by a Type D Roto-Clone. Other foundry applications for Roto-Clone are sand conditioning systems, shakeouts, electric furnaces and abrasive cleaning equipment.



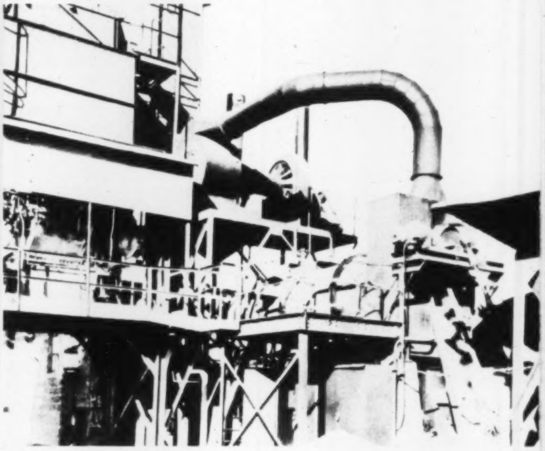
AAF

ROTO-CLONE®
DUST CONTROL EQUIPMENT



BAKERIES

Air-borne flour dust in bakeries coats equipment, floors and walls—creates costly sanitation and maintenance problems. Here's how progressive bakeries have found a profitable solution. Illustration shows installations of AAF Type D Roto-Clone and Airmat Dust Arrester which not only keep working area spic and span at all times but reclaim 230 pounds of flour (formerly a total loss) daily.

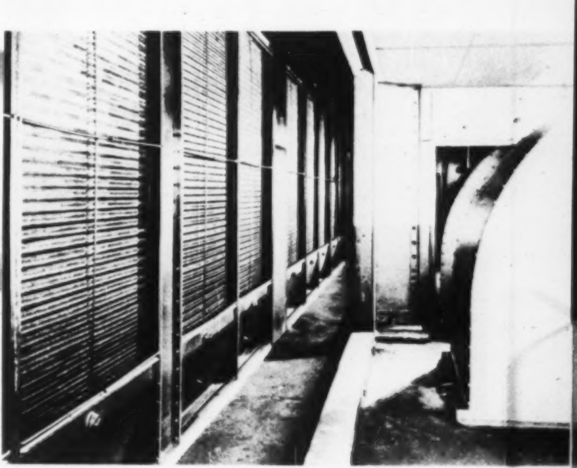


ASPHALT PLANTS

Escaping dust from asphalt plants frequently labels such operations as a public nuisance. This, and scores of similar plants, have turned complaints into compliments by equipping their aggregate dryers with Roto-Clone Dust Control Equipment. There's a saving, too. Fine filler material, formerly wasted, is now salvaged for improving quality of the mix.

in battle against air pollution...

AAF FILTERS prevent entrance of atmospheric dust



AUTOMOTIVE PLANTS

Clean air is an important factor in many operations of the automotive industry. Pictured is a battery of AAF Electro-Cell Precipitators which filter the air for the finishing department of a large auto body builder. Prior to use of filtered air, there were many rejects due to dust specked finishes. Today, such rejects are practically nil.

STEEL MILLS

Mill motors represent a tremendous investment and production schedules hinge on their continuous operation. Since air for cooling these motors is drawn from heavy dust producing areas, it must be thoroughly cleaned of dust and soot. Pictured is a typical installation of AAF Multi-Duty Filters in a large mill motor room.

PHARMACEUTICAL PLANTS

Clean air helps keep medicine healthy. Above all other products, serums, antibiotics and other pharmaceuticals, whether taken orally or by injection, must be free from contamination of airborne dust, bacteria or mold spores. That's why American Air Filters are so widely used throughout the pharmaceutical industry.

AAF

**Automatic electronic precipitator*

AIR FILTERS
AND ELECTRONIC PRECIPITATORS

Whether it's dust from within or without, AAF has the solution to your problem!

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DRY TY
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Roto-Clone Dust Control Equipment ( )

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Company________________
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City________________ Zone______ State________

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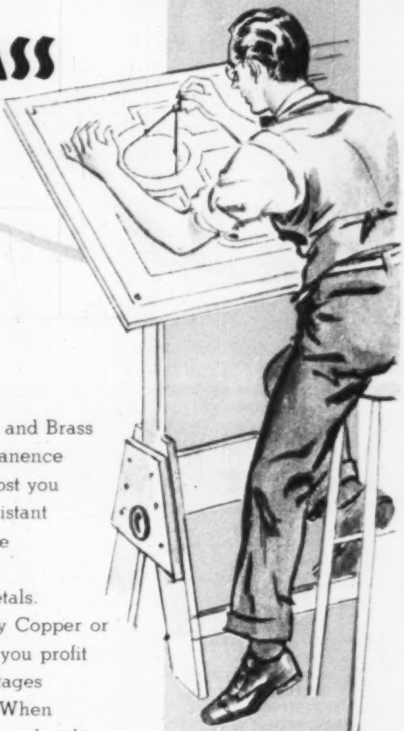
HUSSEY

COPPER AND BRASS

Give Your Products
Dependability at **Low Cost**



Check these Advantages

- ★ **Corrosion Resistance**
- ★ **Electrical Conductivity**
- ★ **Easy Fabrication**
- ★ **Thermal Conductivity**
- ★ **Lifetime Durability**
- ★ **Lasting Beauty**

Versatile Hussey Copper and Brass give your products permanence and dependability at a cost you can afford. Corrosion resistant and durable under severe service conditions, these truly are the *ageless* metals. When you design Hussey Copper or Brass into your product, you profit by the cost-saving advantages of simplified fabrication. When permanence at low cost is a deciding factor in your products . . . design with Hussey Copper and Brass.

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ROLLING MILLS AND GENERAL OFFICES
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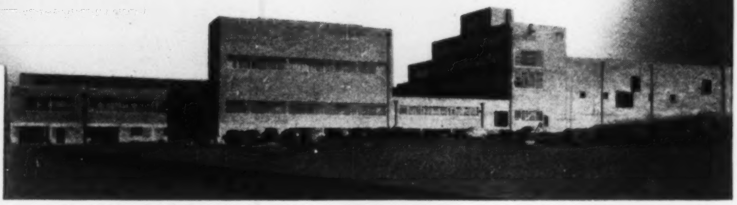
Announcing

MUNDET CUSTOM-MOLDED 85% MAGNESIA HEAT INSULATION



Mundet district offices are located in these cities:

ATLANTA
339-41 Elizabeth Street, N.E.
BOSTON
57 Regent St., North Cambridge 40
CHARLOTTE, N. C.
507 S. Cedar St.
CHICAGO 16
2601 Cottage Grove Avenue
CINCINNATI 2
427 West 4th Street
DALLAS 1
601 Second Ave.
DETROIT 21
14401 Prairie Street
HOUSTON 1
Commerce and Palmer Streets
INDIANAPOLIS
15 E. Washington St.
JACKSONVILLE 6, FLA.
800 E. Bay St.
KANSAS CITY 7, MO.
1428 St. Louis Avenue
LOS ANGELES
(Maywood)
6116 Walker Avenue
NEW ORLEANS 16
315-25 N. Front Street
PHILADELPHIA 39
856 N. 48th Street
ST. LOUIS 9
3176 Brannon Ave.

SAN FRANCISCO 7
440 Brannan Street
In Canada:
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

This new Mundet plant is designed to provide you with superior heat insulation. Its facilities for the manufacture of Custom Molded 85% Magnesia Pipe Covering and Block Insulation are unequalled anywhere in the United States.

Operations are automatic and precision-controlled throughout manufacturing. Specially designed equipment and improved methods contribute to the production of heat insulation that serves more effectively, and at lower life-cost.

By using Mundet Custom Molded 85% Magnesia Insulation, you benefit from:

- *Greater Heat Saving Efficiency*
- *Controlled Uniformity*
- *Longer Life*
- *Custom Molded Precision Pipe Fit*
- *Attractive, Smooth Finish*

Descriptive folder, with simplified thickness standards, sent promptly on request. Write for it now. Mundet Cork Corporation, Insulation Division, 7207 Tonnelle Ave., North Bergen, N. J.

MUNDET

INSULATION FOR HIGH AND LOW TEMPERATURE

ALLSTATE
"Great Growth through Great Service"

The New ALLSTATE INSURANCE COMPANY *Building*
Home Office - Chicago, Illinois

ARCHITECT — Carr and Wright, Inc., Chicago, Illinois

CONSULTING ENGINEER — Robert E. Hattis, Chicago, Illinois

HEATING CONTRACTOR — Gallaher and Speck, Inc., Chicago, Illinois

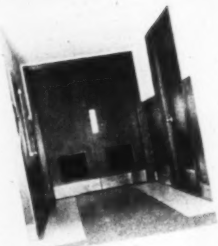
VENTILATING CONTRACTOR — Acord Ventilating Co., Chicago, Illinois

Uni-Flo MA Grilles in typical interior. Grill frames finished to match wall, cores electroplated.

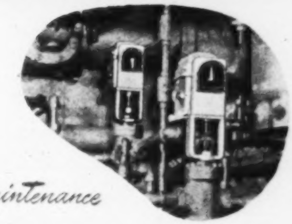
IN THIS COMPLETELY AIR-CONDITIONED BUILDING . . .

BARBER-COLMAN

ONE SOURCE FOR BOTH . . .



Return air grilles in corridor doors — **Uni-Flo** Sight-tite.



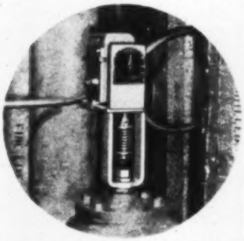
Electric Motor-Operated steam valves.

TEMPERATURE CONTROLS

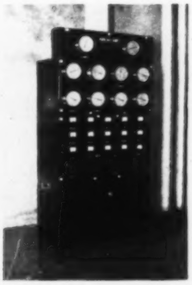
Maximum Performance, Minimum Maintenance

AND Uni-Flo AIR DISTRIBUTION PRODUCTS

Tops in Appearance as well as Performance



Electric Motor-Operated Valve in chilled water line.



One of two fan unit control panels.

In the planning and construction of this building, the architect, engineer, and contractors were able to work with ONE source — Barber-Colman Company — for ALL of the automatic controls AND all of the sidewall and ceiling outlets in the entire building. Keep this name in mind for *your* next project . . .

BARBER-COLMAN COMPANY
1228 ROCK ST., ROCKFORD, ILLINOIS

WAGNER
MOTORS
...The choice of leaders in industry

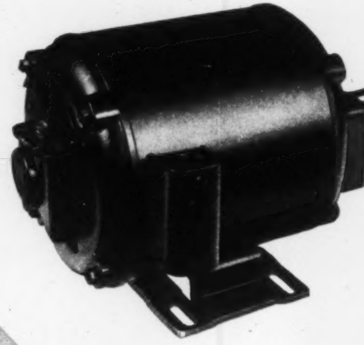
Here's what you get in the WAGNER *Type RA* MOTOR...

the most simplified design to provide—

repulsion start

HIGH STARTING TORQUE . . . for quick, easy starting and smooth acceleration.

LOW STARTING CURRENT . . . to minimize light flicker when motor starts.

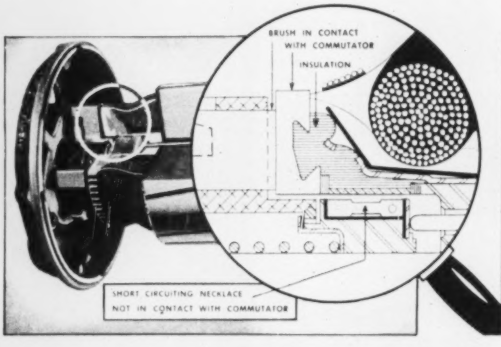


induction run

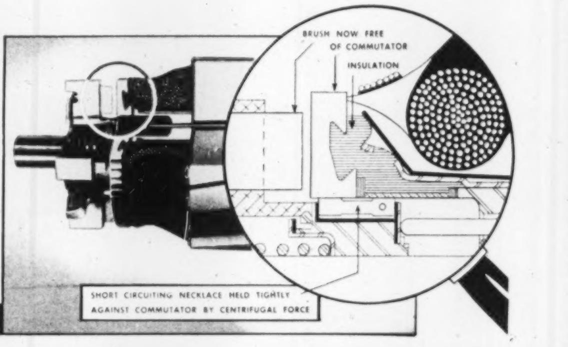
HIGH OPERATING SPEED . . . constant at all operating loads, even under overload.

FLAT EFFICIENCY CURVE . . . over a wide operating range.

Pioneered by Wagner more than half a century ago, the repulsion-start induction single phase motor is truly industry's "general purpose" motor because it combines the best features of two types of motors: the repulsion motor during the starting period and the induction motor while running at rated operating speeds. Today, the Wagner Type RA offers the most simplified, trouble-free design available, and is still the standard by which all other single phase motors are judged. In the Wagner Type RA Motor you get low upkeep cost, minimum servicing, freedom from vibration and noise, and years of reliable service. Shown below are the basic principles of operation of this motor. Bulletin MU-185 gives complete details. Write for a copy.


BRUSH IN CONTACT WITH COMMUTATOR
INSULATION
SHORT CIRCUITING NECKLACE NOT IN CONTACT WITH COMMUTATOR

Starting period—Short-circuiting necklace is not in contact with commutator bars. A governor spring holds barrel in starting position. Brush assembly completes selected circuits enabling motor to start as a repulsion motor.


BRUSH NOW FREE OF COMMUTATOR
INSULATION
SHORT CIRCUITING NECKLACE HELD TIGHTLY AGAINST COMMUTATOR BY CENTRIFUGAL FORCE

Running period—Governor weights (actuating pushrods) have forced spring barrel forward until short-circuiting necklace connects commutator bars to short-circuiting ring, forming a "squirrel cage" to permit operation as an induction motor.

Wagner
Electric Corporation
EST. WE 1891

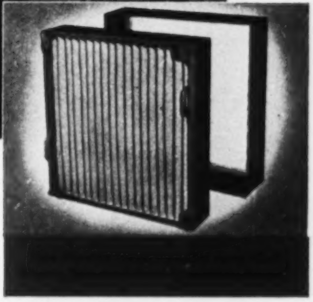
M50-6

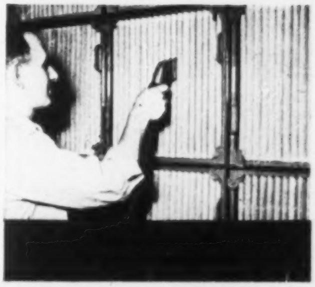
WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES

This building needs Staynew Dry-type Filters...

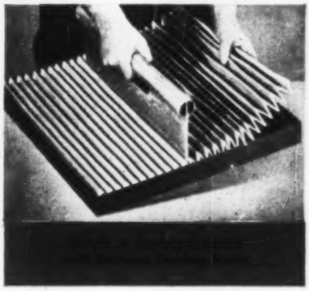


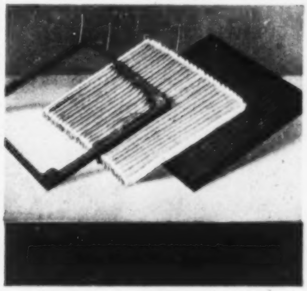


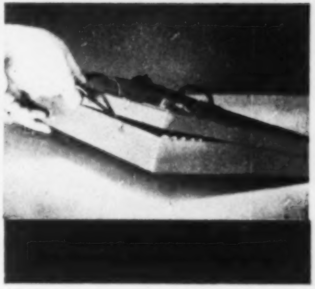
OIL CARRY-OVER from oil-charged viscous type ventilation filters *can* cause expensive damage to fine furnishings—or to valuable goods in process of manufacture. Be safe—use Staynew WKE Dry-Type Filters and avoid any possible chance of such damage.

Save money, too. Staynew Dry-Type Filters are considerably less expensive to maintain. (Detailed figures on comparative maintenance costs available on request.)

FIRE UNDERWRITERS APPROVED—Oil in filters and oil accumulation in ductwork may be dangerous. Why take any chance at all on increasing fire hazard? Staynew WKE Filters with B-G medium not only lick the oil accumulation problem but are Fire Underwriters' Class I Approved.







FOR COMPLETE DETAILS WRITE:

DOLLINGER CORPORATION

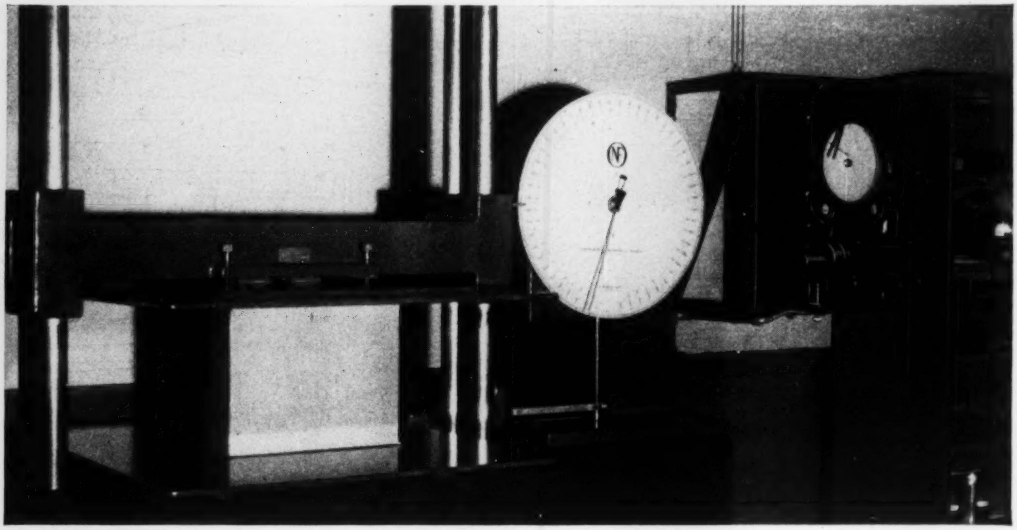
9 CENTRE PK., ROCHESTER 3, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

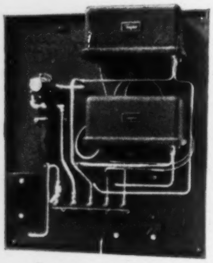
DOLLINGER
PROTECTOMOTOR
STAYNEW FILTERS

±1% HUMIDITY CONTROL

with Taylor Instruments in Ohio Boxboard Lab



±1% relative humidity is maintained by Taylor Wet-and-Dry Bulb temperature controller (right) in Ohio Boxboard test laboratory.



TRANSAIRE with Speed-Act, on a Taylor Wet-and-Dry Bulb Temperature Controller.

WOULDN'T YOU like to buy humidity control on the basis of *percentage of humidity*—instead of on the individual performance of wet and dry bulbs?

That's what the Avery Engineering Company, with Taylor's close cooperation, supplied Ohio Boxboard Company for their Rittman, Ohio, laboratory. Humidity is controlled within ±1% to provide standard conditions for physical testing of products.

This amazingly close humidity control is achieved by a Taylor FULSCOPE* Recording Wet-and-Dry Bulb Controller (above right) using as measuring systems two Taylor TRANSAIRE* Temperature Transmitters with Speed-Act (see cut at left).

Thanks to Speed-Act, the lags due to poor conductivity are compensated for, resulting in better measurement and control—within ±1% relative humidity.

Whether you manufacture paper or any other product where humidity control is vital, it will pay you to look into Taylor Automatic Control with TRANSAIRE Transmitters. Ask your Taylor Field Engineer or write for **BULLETIN 98140.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.

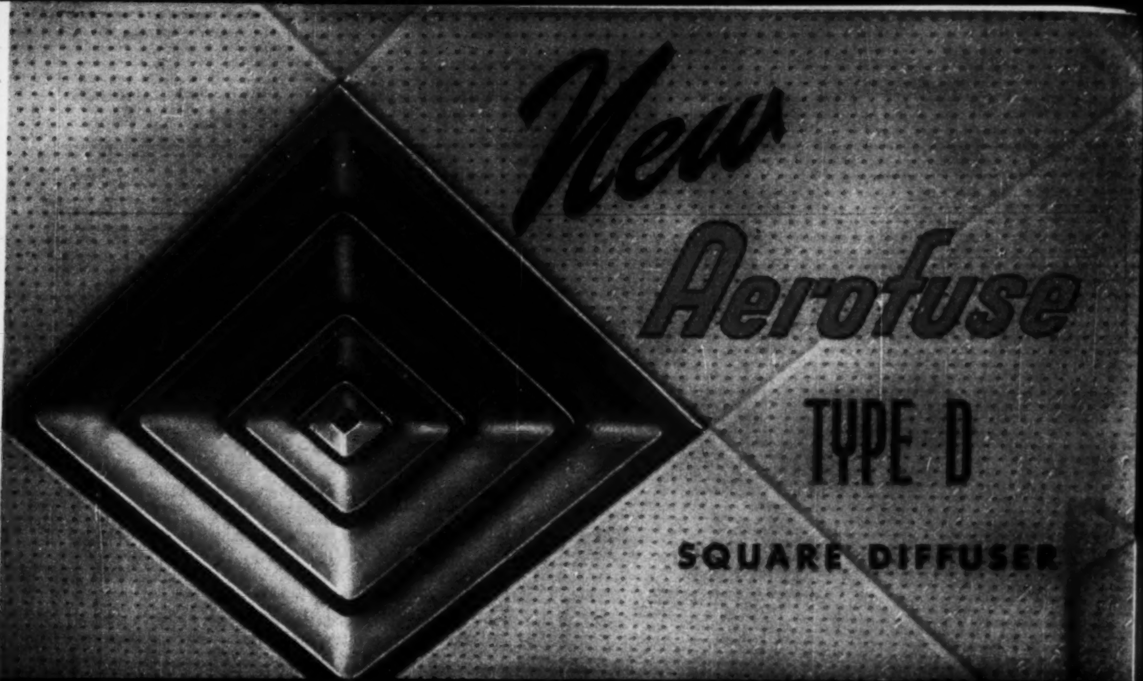
Taylor Instruments

MEAN

ACCURACY FIRST

IN HOME AND INDUSTRY

*Trade Mark

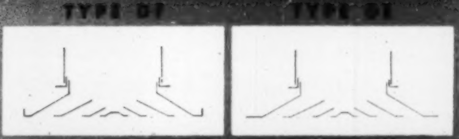


New Aerofuse

TYPE D

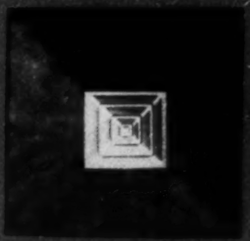
SQUARE DIFFUSER

360° AIR DISTRIBUTION or any required pattern at the vital point of air delivery



Styled to harmonize with modern architectural design . . . engineered for efficient performance . . . the new Type D Aerofuse is the answer to demands of both architect and engineer for a square diffuser that will deliver supply air in a 360° pattern. Assuring a complete flexibility to meet specific job requirements where circular distribution is not practical, baffles may be used to block off any portion of the diffuser and direct air stream in a variety of patterns, as illustrated below.

Two types are available . . . Type DF for flush mounting in standard acoustical tile ceilings . . . Type DE, for installation on plaster ceilings. Both types are listed in five sizes (12"x12", 16"x16", 20"x20", 24"x24", 30"x30") with neck diameters from 6" to 15".



For complete details on the Type D Aerofuse, size selection information and engineering data . . . send for Catalog 103.

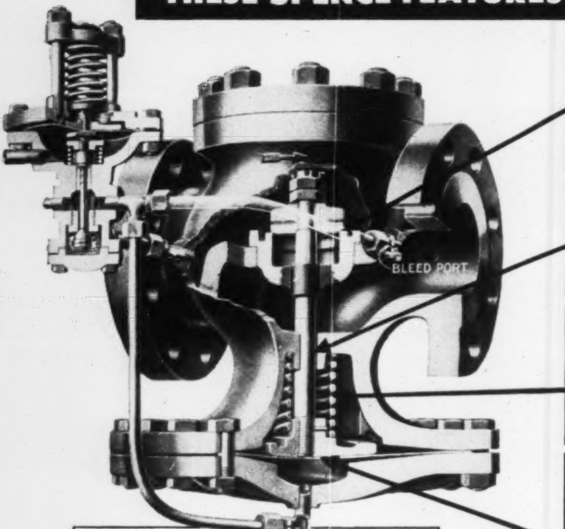
TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. *More than twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

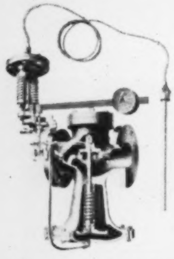
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

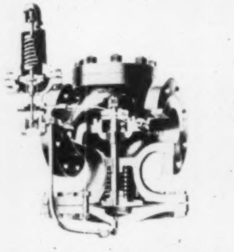
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

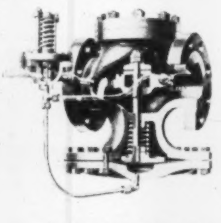
Spence Pressure and Temperature Regulators are built in sizes from ¼" *to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

3-Story San Francisco Office Building Installs Chase Copper Tube Radiant Heating!

HERE'S WHY you too will want Chase Copper Tube in your Radiant Heating Installations!

EASY TO BEND • LONG LENGTHS • LOW COST
LIGHT IN WEIGHT • SOLDERED FITTINGS • LONG
LIFE • SMALL DIAMETER

60,000 feet of Chase Copper Tube were used in this concrete floor radiant panel heating installation in the National Red Cross Building in San Francisco. Architect: Gardner A. Dailey & Associates. General Contractor: Swinerton & Walberg. Heating Contractor: Robert Bruen & Son, Oakland, Calif.

CHASE COPPER TUBE means easier installation in large radiant heating applications. Long coils, in 60 and 100 foot lengths, reduce number of connections . . . soft temper, small-diameter tube bends by hand . . . joints quickly made with solder-joint fittings.

Chase Copper Tube's light weight and long life are important, too. Get economical installation plus lasting service with Chase!

SEND FOR FREE BOOK. Just mail the coupon for helpful information on the design of radiant heating installations.

Chase Brass & Copper Co., Dept. HPA 1050
Waterbury 20, Conn.
Gentlemen: Please send your book, "Suggestions for Designing Radiant Panel Heating with Copper Tube."
FIRM__________
NAME__________ TITLE__________
STREET__________
CITY__________ STATE__________

Chase *the Nation's Headquarters for* BRASS & COPPER

WATERBURY 20 CONNECTICUT
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*
ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER† DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY (†Sales Office Only)

DRAVO HEATERS..

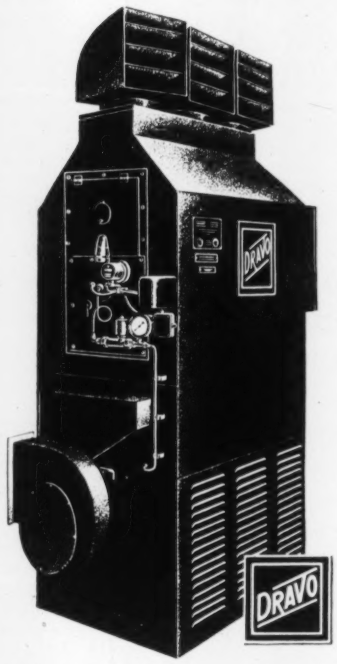
AS WELL AS MONEY....FUEL...

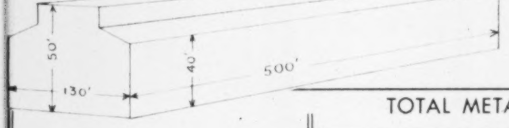
Heating system steel needs *can* be slashed from 50% to 70% for the representative open-space industrial structure shown below . . . by using the direct-fired warm air heating method with Dravo "Counterflo" Heaters! This conservation, of vital importance today, adds another to the long list of economies in money, fuel and labor effected by this heating method.

The chart below gives the detailed comparative story. Every system is equivalent in Btu output. Steel requirements for the 13 methods have been carefully and conservatively calculated.

It will be noted that Dravo Heaters not only take LESS steel in each fuel classification . . . but that the HIGHEST steel requirement in a Dravo installation is almost 50% less than the LOWEST steel requirement in any other system. Of special significance is the contrast in *pipe* required. Jobs now held up by slow pipe deliveries can MOVE . . . if Dravo Heaters are used!

Any time that YOUR jobs are delayed or deferred because of steel or pipe shortages, why not find out how Dravo "Counterflo" Heaters are expediting things for other users? And remember — steel savings are just *one* of the reasons that more and more Dravo "Counterflo" Heaters are heating increasing numbers and types of structures. You'll find many other good reasons listed at right, that will appeal to you.





Each heating system compared below was sized to make up a calculated 12,000,000 Btu heat loss in this representative industrial building.

TOTAL METAL REQUIREMENTS FOR VARIOUS HEATING SYSTEMS

	GAS FIRED					OIL	
COMPONENT	**DRAVO WARM AIR**	**HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER**	**HIGH PRESSURE PACKAGED STEAM GENERATOR**	**LOW PRESSURE CONVENTIONAL WATER TUBE BOILER**	**LOW PRESSURE PACKAGED STEAM GENERATOR**	**DRAVO WARM AIR**	**HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER**
BASIC HEAT GENERATORS	26,400	38,000	62,000	38,000	62,000	26,400	38,000
PIPING—Oil—Steam Boiler Room—Gas	9,096	15,490	15,490	35,308	35,308	4,352	15,790
TANKS—Oil—Blow-off Condensate		3,500	1,500	1,500	1,500	13,000	16,500
UNIT HEATERS including Traps & Starters		21,240	21,240	21,240	21,240		21,240
STACKS & BREECHING	1,200	4,000	400	4,000	400	1,200	4,000
PUMPS—Fuel Oil Auxiliary Oil—Boiler Feed		1,000	1,000	1,000	1,000	400	1,400
STOKERS & FANS—including Dust Collectors Fuel Oil Preheaters							2,000
STRUCTURAL STEEL Boiler House Foundation Reinforcing		7,000	2,000	7,000			7,000
TONS of STEEL REQUIRED	DRAVO **18**	**45**	**52**	**54**	**61**	DRAVO **23**	**53**

..SAVE STEEL

.AND MAN HOURS

DISTRIBUTION PIPING AND DIFFUSERS COMPLETELY ELIMINATED

LEAST STEEL PER 1,000,000 BTU OUTPUT

NO VALVES, TRAPS OR FITTINGS

STAINLESS STEEL CHAMBER ELIMINATES REPLACEMENT

DRAVO CORPORATION

HEATING DEPT., DRAVO BUILDING, PITTSBURGH 22, PA.
Sales Representatives in Principal Cities.
Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec.

WITH IDENTICAL 12,000,000 Btu LOAD					
FIRED →			← COAL FIRED ←		
HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER
62,000	38,000	62,000	27,450	38,000	38,000
15,790	35,608	35,608		14,990	34,808
14,500	14,500	14,500		3,500	1,500
21,240	21,240	21,240		21,240	21,240
400	4,000	400	1,200	4,000	4,000
1,000	1,400	1,000		1,000	1,000
	2,000		23,850	15,000	15,000
2,000	7,000			7,000	7,000
58	**62**	**67**	DRAVO **26**	**52**	**61**

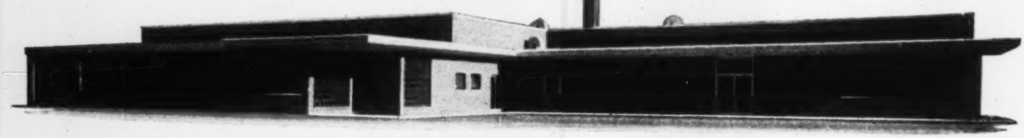
DRAVO HEATERS HAVE EARNED HIGHEST ACCEPTANCE BECAUSE THEY

- *use less steel*
- *eliminate distribution piping*
- *have lower initial cost*
- *are very efficient in fuel consumption*
- *concentrate comfort heat at the working level*
- *reduce roof heat losses*
- *burn gas or oil*
- *are available in coal burning models*
- *save man hours through automatic operation*
- *require no attendant and negligible maintenance*
- *produce heat instantly and ONLY when needed*
- *have stainless steel chambers for longer life*
- *prevent rust and stain conditions in metal storage*
- *bear UL label and AGA approval*
- *require only stack, fuel and power line*
- *are portable and readily moved*
- *provide year 'round ventilation*
- *are ideal for process drying*
- *avoid freeze up worries, leaky traps, valves, etc.*
- *are shipped complete and flame tested*
- *can be installed on floor, wall or roof*
- *can be mounted upside down or horizontally*
- *eliminate ductwork with 150 ft. air throw*

WRITE TODAY FOR BULLETIN HI—523—8091

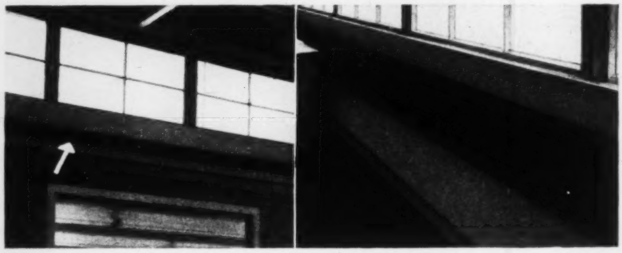
"WE LIKE VULCAN"

.. because it's the smoothest heat for office comfort and plant efficiency we've ever experienced"



The Taylor & Greenough Co., Wethersfield, Conn.
IRVING W. RUTHERFORD
Architect and Engineer
MARINO PLUMBING & HEATING CO.
Heating Contractor

That's what the owners of the newest, most modern printing plant, in New England, shown above, say about their Vulcan installation . . . . .



HIGH LOW

HIGH . . Vulcan installed beneath the clerestory windows, shown at left, in the large, high-ceiling area, *warms* these cold air surfaces, eliminates uncomfortable cold down-drafts, insures the *uniform distribution of heat* that is typical of all Vulcan installations.

LOW . . Vulcan two-high running the full length of this modern glass wall provides a convection blanket of warm air that fully protects the personnel, provides the utmost heating comfort for ideal working conditions.

RIGHT: A short length of Vulcan Standard beneath the glass brick wall in the reception room.

"You wouldn't know there was a Vulcan fin tube heating unit under that attractive cover."

THIS IS VULCAN

The modern heating
for modern buildings

SCHOOLS, HOSPITALS, INDUSTRIAL PLANTS *and* PUBLIC BUILDINGS

REPRESENTATIVES IN PRINCIPAL CITIES

Made in Canada, under trade name of Heal Radiation, by the Vapor Car Heating Co. of Montreal.

Specify VULCAN
IT HAS NO EQUAL

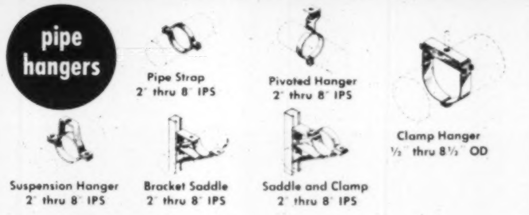
THE VULCAN RADIATOR CO.
26 FRANCIS AVENUE HARTFORD, CONNECTICUT

UNISTRUT *Brings you the Best...*

IN MECHANICAL PIPING SUPPORTS!

NO DRILLING, NO WELDING, COMPLETELY ADJUSTABLE AND REUSABLE!

pipe hangers



Pipe Strap 2" thru 8" IPS

Pivoted Hanger 2" thru 8" IPS

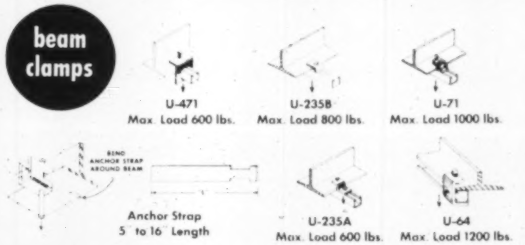
Clamp Hanger ½" thru 8½" OD

Suspension Hanger 2" thru 8" IPS

Bracket Saddle 2" thru 8" IPS

Saddle and Clamp 2" thru 8" IPS

beam clamps



U-471 Max. Load 600 lbs.

U-235B Max. Load 800 lbs.

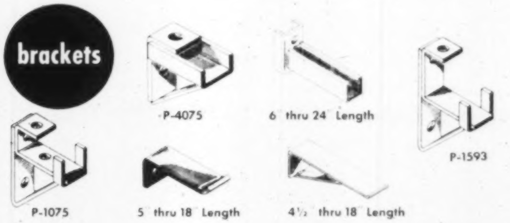
U-71 Max. Load 1000 lbs.

Anchor Strap 5" to 16" Length

U-235A Max. Load 600 lbs.

U-64 Max. Load 1200 lbs.

brackets



P-4075

6" thru 24" Length

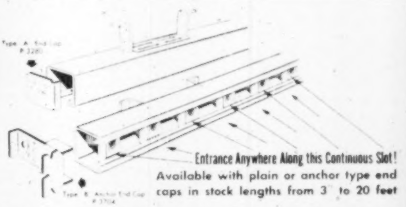
P-1593

P-1075

5" thru 18" Length

4½" thru 18" Length

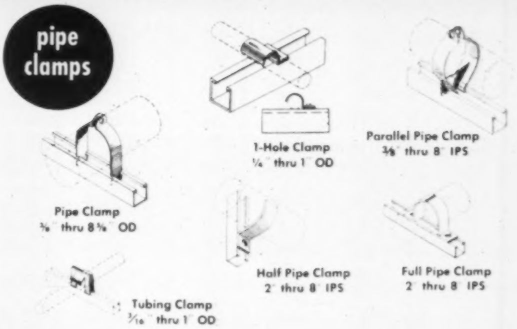
concrete inserts



Entrance Anywhere Along this Continuous Slot! Available with plain or anchor type end caps in stock lengths from 3" to 20 feet

LOAD DATA— Recommended loading on inserts in average good concrete, with safety factor of 3, follows: P-3249—500 lbs. • P-3250—800 lbs. P-3251—1000 lbs. • P-3252—1200 lbs. • P-3253 thru P-3270—2000 lbs. per foot

pipe clamps



1-Hole Clamp ¼" thru 1" OD

Parallel Pipe Clamp ⅜" thru 8" IPS

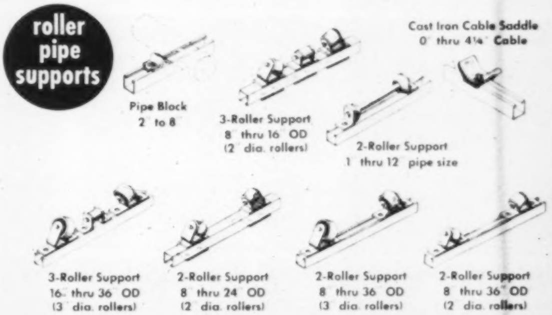
Pipe Clamp ⅜" thru 8⅝" OD

Half Pipe Clamp 2" thru 8" IPS

Full Pipe Clamp 2" thru 8" IPS

Tubing Clamp 3⁄16" thru 1" OD

roller pipe supports



Cast Iron Cable Saddle 0" thru 4¼" Cable

Pipe Block 2" to 8"

3-Roller Support 8" thru 16" OD (2" dia. rollers)

2-Roller Support 1" thru 12" pipe size

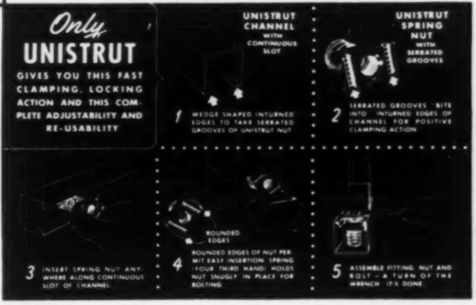
3-Roller Support 16" thru 36" OD (3" dia. rollers)

2-Roller Support 8" thru 24" OD (2" dia. rollers)

2-Roller Support 8" thru 36" OD (3" dia. rollers)

2-Roller Support 8" thru 36" OD (2" dia. rollers)

Unistrut Fittings and Supports shown on this page combined with Unistrut Channel Provide the World's Most Flexible System of support or suspension



Only UNISTRUT GIVES YOU THIS FAST CLAMPING, LOCKING ACTION AND THIS COMPLETE ADJUSTABILITY AND RE-USABILITY

UNISTRUT CHANNEL WITH CONTINUOUS SLOT
UNISTRUT SPRING NUT WITH SERRATED GROOVES
ROUNDED EDGES

1 WEDGE SHAPED INTURNED EDGES TO TAKE SERRATED GROOVES OF UNISTRUT NUT

2 SERRATED GROOVES "BITE INTO" INTURNED EDGES OF CHANNEL FOR POSITIVE CLAMPING ACTION

3 INSERT SPRING NUT ANYWHERE ALONG CONTINUOUS SLOT OF CHANNEL

4 ROUNDED EDGES OF NUT PERMIT EASY INSERTION. SPRING (YOUR THIRD HAND) HOLDS NUT SNUGLY IN PLACE FOR BOLTING

5 ASSEMBLE FITTING, NUT AND BOLT – A TURN OF THE WRENCH IT'S DONE

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U. S. Patent Numbers
2327587 2363382
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Free Catalog and Wall Chart!

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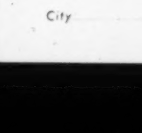

UNISTRUT PRODUCTS COMPANY
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Chicago 7, Illinois, Dept. H-10

Please send me your Construction Catalog No. 500 and Wall Chart, without obligation.

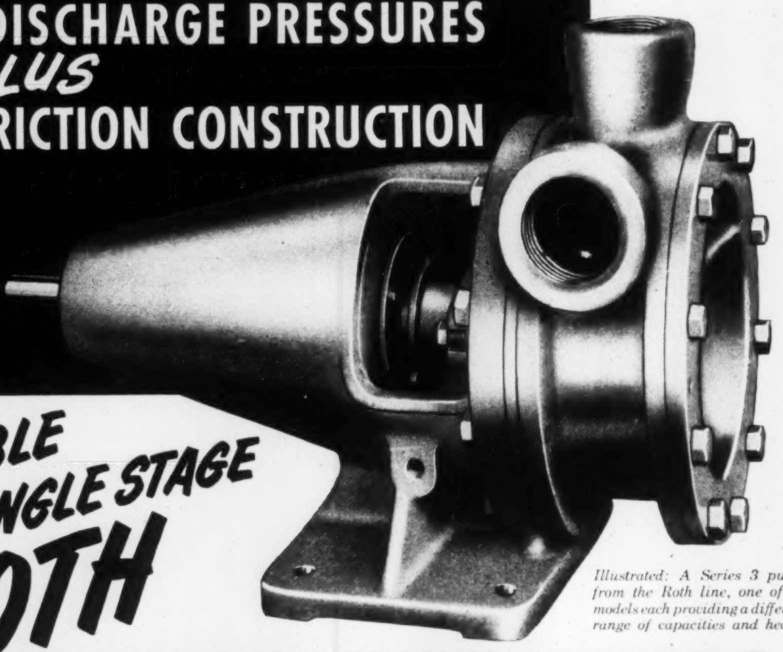
Name

Company

Address

City Zone State

HIGH DISCHARGE PRESSURES *PLUS* ANTI-FRICTION CONSTRUCTION



Illustrated: A Series 3 pump from the Roth line, one of 62 models each providing a different range of capacities and heads.

AVAILABLE IN A SINGLE STAGE IN ROTH TURBINE TYPE PUMPS

Roth Turbine Type pumps fill a need between conventional centrifugal and rotary designs . . . combining the high discharge pressures of rotary pumps with the friction free operation of centrifugals. Capacities range from one to 200 gpm, heads range to 500 feet.

APPROXIMATE SELECTION because of their wide operating range, makes Roth Turbine Type pumps most practical for applications where head conditions cannot be accurately determined in advance or are subject to variation.

RECOMMENDED APPLICATIONS include the food and chemical industries where the ability to pump from vacuum at 29½ inches with only three feet suction head offers installation economies not possible with other types of equipment. For the heating engineer who must pump water at near boiling point, the self-venting, vapor clearing characteristics plus the high discharge head in a single stage make Roth pumps essential for boilers up to 750 HP. For the petroleum industry, these same advantages become increasingly important with the increased use of LPG. Cooling towers, water treatment equipment, filter presses, centrifugal separators, steam generators and water systems are among other recommended applications.

SPECIAL METALS for the chemical and food industries are available for quick delivery. 18-8 and 316 stainless pumps are stocked in many sizes while Hastelloy, special bronzes, illium, or ni-resist pumps can be made to order. The simplicity of design of the liquid end lends itself to construction in special metals quite readily.

CONSTRUCTION FEATURES include positive location of the impeller which eliminates metal-to-metal contact, accomplished with a combination of bearing pre-loading spring, sealed ball bearings and a particularly rugged stainless shaft. Packing maintenance is reduced since Roth pumps have only a single box. Easy access to the liquid end is provided by mounting both ball bearings on one side of the impeller. The outboard head and the impeller may be removed without disconnecting piping or disturbing pump and motor location.

For details and recommendations on the Roth Turbine Type pump for your own installation, write direct or contact your nearby Roth distributor.

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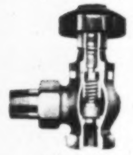
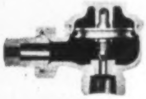
ILLINOIS *Heating System* CONTROLS

Type C Controller and Panel
Type E Valve and Control Panel
Type A Valve and Control Panel


Series 48
Radiator Valve


Series G
Radiator Trap

Series G Float and
Thermostatic Trap

Illinois stresses the importance of control . . . not only for comfort and convenience . . . but fuel conservation as well. These control systems are offered in three types and each admits of modifications to meet special conditions. They are:

GENERATION Control . . . Type C

For independent boiler installations affording the maximum in fuel economy. Controls steam generation as well as steam circulation . . . a double economy.

CONTINUOUS FLOW Control . . . Types A and M

In installations which require zoned control, or where steam is used for other than heating and domestic hot water service, or where steam is supplied by Central Station Service, these systems are recommended. Illinois Flow Control Valves of the full floating type give complete and accurate regulation of steam flow. Furnished for pneumatic or manual operation, singly or in combination.

CYCLING FLOW Control . . . Type E

These systems have a wide range of application for automatic or manual control of steam flow and pressures not only in vacuum systems but in one-pipe or two-pipe gravity installations as well.

●

In addition to controls, ILLINOIS is also known from coast to coast for high efficiency standard vacuum and vapor systems. ILLINOIS specialties have the cumulative experience of 50 years built into them.

Write for bulletins

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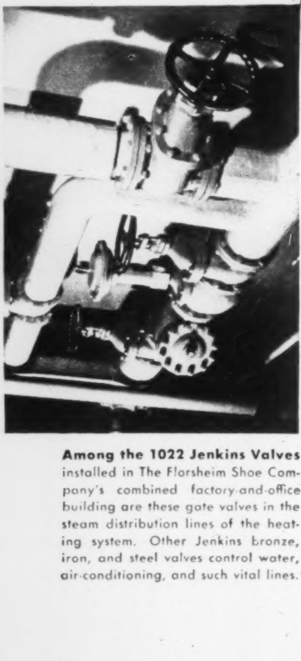

Among the 1022 Jenkins Valves installed in The Florsheim Shoe Company's combined factory-and-office building are these gate valves in the steam distribution lines of the heating system. Other Jenkins bronze, iron, and steel valves control water, air-conditioning, and such vital lines.

With its unbroken horizontal tiers of grey brick curtain walls which "seem to float in thin air", acres of glass their only visible means of support, the new home of The Florsheim Shoe Company in Chicago might be called an industrial "dream home"

It is certainly one of America's most notable examples of future-minded planning. Like the production machines used in cutting, lasting, stitching, and finishing Florsheim Shoes, the equipment installed for building operation is the most efficient modern engineering has devised. Here, Jenkins Valves "fit perfectly".

In fact, because of their dependability, safety and lasting economy, Jenkins Valves have been the choice, consistently, of leading architects, engineers and contractors for the towering skyscrapers, huge industrial plants, and super airports that are making today's building news.

Jenkins builds extra endurance into valves — proved by low upkeep cost records in every type of service. Yet, despite this extra value, *you pay no more* for Jenkins Valves. For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy.

Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal

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VALVES
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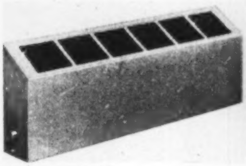
EQUIPMENT DEVELOPMENTS...

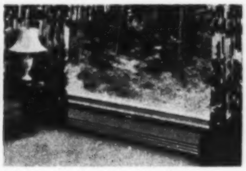
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1950 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed

IF YOU HAVEN'T received information you have asked for by the coupon which appeared on this page in August, it may be that your request was in a file box of coupons taken from our office. We don't know why anyone else wanted this material . . . , it must have been the box they were after. We regret the occurrence and will appreciate hearing from you if you have not obtained the information you have requested.

Convectors

HPAC 1—A new convector having an overall height of 12 in. is now available from Modine Mfg. Co., Racine, Wis., for free standing or recessed installation under picture windows. Known as the type F-12, it is available in 6 and 8 in. depths and in eight lengths ranging from 40 to 96 in. Enclosures longer than 72 in. are designed with removable center supporting legs and dual dampers and lower grilles (optional) are provided.





The new type S-14 convector is intended for heating bathrooms or other areas where the heat loss is small or space is limited. A sloping top wall cabinet type, it is 11 in. high and 4 in. deep and is offered in 10, 18, and 26 in. lengths. It may be installed as low as 3 in. above the floor.

Gas Fired Unit Heater

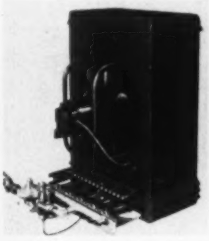
HPAC 2*—The Trane Co., La Crosse, Wis., has expanded its line of air conditioning, heating and ventilating equipment to include a new line of gas fired unit heaters.

Designed for use with either natural, manufactured, mixed or liquid petroleum gas, the unit's heat generator includes burner heads and mixing tubes of one piece cast iron construction. Burners, pilot and control valves are combined in one drawer-type assembly and there are no gaskets. A high limit switch is used to prevent overheating, while both gas main and pilot light cut off automatically in case of failure. The fan may be controlled by a room thermostat.

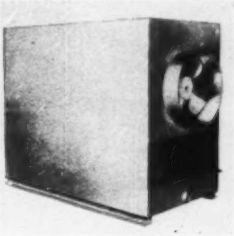
The heart of the new heater is the "Torrid Tube" heat exchanger. Its steel tubes, sized for easy air passage, are rolled into end sheets, boiler tube style, and are fortified with additional outer and inner rolled flanges. A built-in draft diverter is designed to allow back drafts and updrafts to bypass the burner assembly without affecting the burner's operation.

The new unit heaters are produced in seven sizes with capacities from 50,000 Btu per hr to 210,000 Btu per hr input and 700 cfm to 2700 cfm.

In the rear view illustration, the drawer type heat generator has been pulled out and exposed.



Gas Fired Unit Heater



Cooling Tower

Packaged Cooling Towers

HPAC 3—The new series P packaged cooling towers of J. F. Pritchard & Co., 908 Grand Ave., Kansas City, Mo., are available in three models with capacities ranging up to approximately 20 tons.

The deck filling and drift eliminators are made of California redwood and the propeller fan is mounted directly on the motor shaft. The basin is equipped with an automatic float valve, a screen suction connection and a com-

[*Continued on page 183*]

FOR YOUR CONVENIENCE [10-50]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

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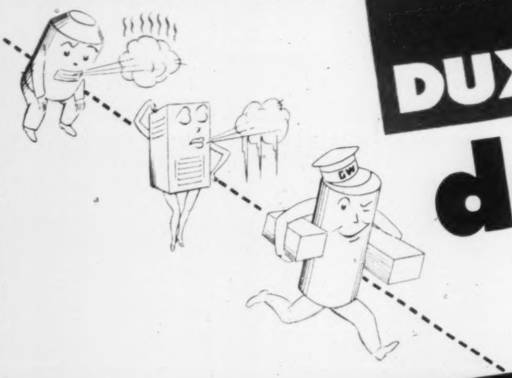

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delivers it.....

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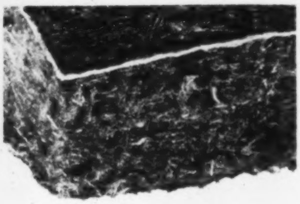

The Package...

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ACTUALLY COSTS LESS TO USE!

Designed specifically for duct work, Dux-Sulation has **ALL** the characteristics essential to maximum efficiency . . . extremely high insulating value, simple and fool-proof application, not subject to deterioration or aging of any kind, integral asbestos fire-proofing membrane, handsome appearance, no external covering or protection required, no screws, bands or other fasteners to buy or bother with.

Find out about **all** the "plus-values" Dux-Sulation offers — both in **delivered comfort** as well as **installed cost!** Write us for Bulletin 410-H today!

Write Grant Wilson, Inc., 141 W. Jackson Blvd., Chicago 4, Ill., for complete facts and prices.

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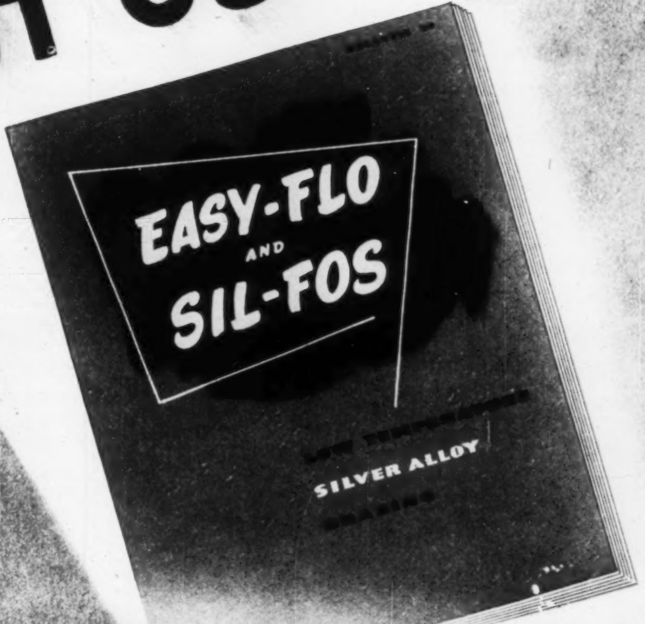

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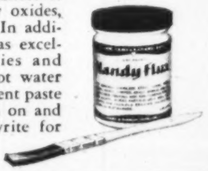

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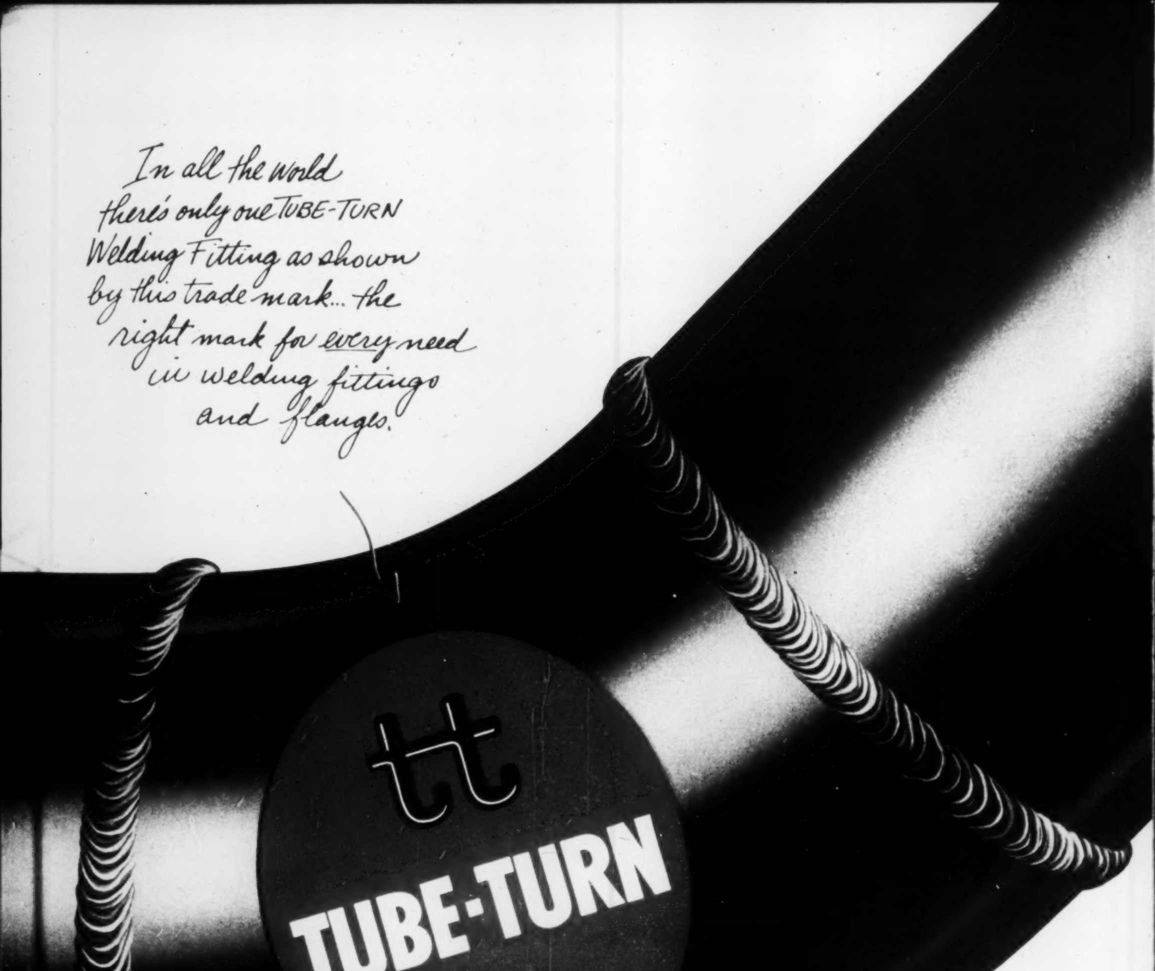

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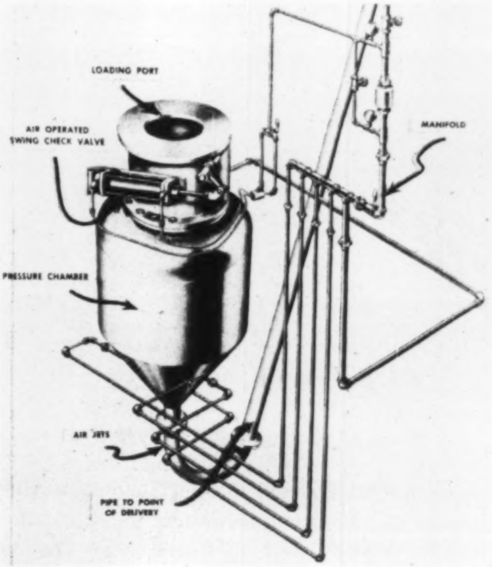
[*Continued from page* 179]

bination overflow and drain. Optional equipment includes fan guards and inlet screen and distribution fan covering. Units are available in painted steel, stainless steel or monel metal and are either shop assembled or knocked down.

Pneumatic Conveyor System

HPAC 4—A new pipe line conveyor called "Turbo-Drive" has been developed by Crane Co., 836 S. Michigan Ave., Chicago 5. Operating from air pressure, it consists of an entrance or swing check valve through which the material to be transported is loaded into the pressure chamber. Air pressure is controlled by a manifold incorporating several valves and a pressure regulator. Also included are the pipe, bends, switches and fittings necessary for delivering the material to the point of use.



The system is especially designed for batch moving of sand or other granular, crushed, or pulverized materials from receiving to storage and from storage to point of use. According to the company, each batch is delivered complete, thus eliminating contamination between successive batches when moving different materials. Since the material is enclosed in a steel pipe it is kept clean. A ton or more of material can be moved in a few minutes.

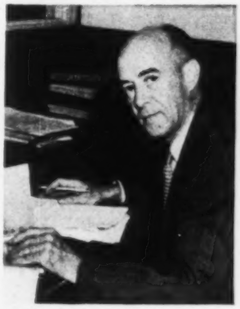
The entire system is controlled by a single operator located at the storage or mixing source. Dispatch to more than one location is made possible through the use of a transfer switch. The conveyor is available in three sizes —7, 15, and 30 cu ft capacity. Air pressure required for operation depends upon the material, size of batch and the distance to be moved.

Refrigeration Compressor

HPAC 5—Frick Co., Waynesboro, Pa., has added a nine cylinder refrigeration machine to its line of new "Eclipse" compressors.

These "Freon" compressors are now furnished in five sizes, having two, three, four, six or nine cylinders. The

These men are working for you



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No general practitioners, these men are recognized piping authorities, possessing highly specialized knowledge and training in the field of piping engineering. Together, they represent a total of more than 100 years experience in the design and application of piping, fittings, and flanges for power, oil, chemical, marine, and general industrial service.

Aided and abetted by a corps of trained technicians, their efforts are consistently directed toward one never-changing goal: *better welding fittings and flanges to serve you better!*

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"Be Sure You See The Double tt"

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Cut Installation and Service Time

Thermo-Anemometer checking baseboard convector

Thermo-Anemometer in refrigerated space

Thermo-Anemometer check draft in room corner

Alnor
THERMO-ANEMOMETER

with Quick, Precise Low Air Flow Readings!

Time spent in checking and adjusting low air velocities can account for a large part of the cost of any installation or service job. The fastest and surest way to measure air velocities in the lower ranges is with the Alnor Thermo-Anemometer. With laboratory accuracy this direct reading, self-contained instrument makes possible extremely precise readings — as low as 5 f.p.m. Drafts within occupied rooms . . . flow from convectors, grilles, registers . . . air flow in refrigerated spaces . . . these and many more are ideal uses for this compact, portable instrument. Send today for complete details.

Send for Bulletin!

Use the coupon to get your copy of bulletin 913 which has complete details, scale ranges and price of the Alnor Thermo-Anemometer.

ILLINOIS TESTING
LABORATORIES, INC.
Room 513, 420 N. LaSalle St., Chicago 10, Ill.

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Alnor

PRECISION INSTRUMENTS
FOR EVERY INDUSTRY

ILLINOIS TESTING LABORATORIES, INC.
Chicago 10, Illinois

largest machine has a nominal capacity on air conditioning work of 90 tons.

The nine cylinder machine has three banks of cylinders, and the angle between the vertical cylinders in the center and the banks at the sides is arranged to give an even torque on the shaft. The banks are staggered to permit the connecting rods from three cylinders to engage one crank on the shaft.

Grouped on the solid end of the crankcase, opposite the belt wheel, is the force feed oiling equipment, including the pump, regulating valve, pressure gage, suction screen, filling valve and bullseye. Oil and gas equalizing connections are provided for operating two or more compressors in parallel. The oil returning with the suction gas is drained back to the crankcase from each bank of cylinders through a special device which is used to equalize the pressures without sudden changes.

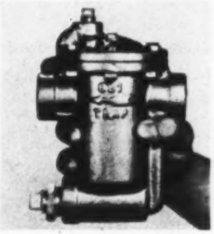
The cylinder heads and pistons can be removed without disturbing the pipe connections, motor, or v belt drive. Manifolds and cylinders are separate and exposed to ambient temperatures. This is said to reduce to a minimum the passage of heat from discharge gas to suction gas and to permit operation with minimum superheat losses. Capacity controls, when required, are actuated by discharge pressure and are arranged to hold open the suction valves of one or two cylinders in a bank.

Piston Valves for Convectors

HPAC 6*—A new line of control valves with piston operators, for convector installations and other applications in confined spaces where ordinary control valves cannot be accommodated, has been developed by Johnson Service Co., 507 E. Michigan St., Milwaukee 2.

Adaptable to almost any type of piping connection for proportional control of low pressure steam or hot or cold water, they are made in ½ and ¾ in. pipe sizes. In addition to conventional union angle and union globe patterns, reverse flow, double union angle, and female union inlet globe bodies are offered. In the water valves, a v ring, self sealing packing utilizes the force of the water pressure to effect a positive seal. No adjustment for static head or wear is required. For low pressure steam service, specially compounded molded split ring packings are said to provide long life with a minimum of attention. They are readily accessible for adjustment or replacement.

Convector Valve


Steam Trap

Steam Trap

HPAC 7—Armstrong Machine Works, Three Rivers, Mich., is now making available another small inverted bucket steam trap which has a brass strainer built into the body. Known as the No. 881, this side inlet, side outlet trap is used for draining smaller sized equipment

Mueller Climatrol

Gas Unit Heaters

(Propeller Fan or Blower Types)

Proof of **SUPERIORITY** **is here..**

① **One Piece — All welded Steel** — No tie-rod, bolted, gasketed, or slip joints to leak, separate, or crack.

② **Uniform air flow and heat distribution** — Even flow of air insures maximum heat transfer and fuel economy.

③ **High Crown Sheet** — No flame impingement, no "hot spots". No joints or welds exposed to flame or path of flue gases.

MUELLER Climatrol Direct Gas-fired Unit Heaters fit any application, with both the Type 150 (propeller fan) and Type 151 (blower, not shown) to choose from. Each is AGA approved for all gases, and is available in four input capacities: 60,000, 90,000, 120,000, and 150,000 Btu.

With the Types 150 and 151 you can assure longer life, *plus* greater operating economy. And, you can deliver jobs faster because these units are *shipped assembled and pre-wired.*

Get behind the Types 150 and 151. Write for information . . . *L. J. Mueller Furnace Co., 212 W. Oklahoma Ave., Milwaukee 15, Wisconsin.*

MUELLER — Climatrol

REG. U. S. PAT. OFF.

93rd Anniversary

FOR GAS FOR OIL FOR COAL

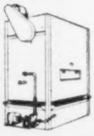
HOW TO SAVE UP TO
$5,000
ON AIR CONDITIONING
GOVERNAIR
COMPLETELY PACKAGED
AIR CONDITIONER
PAT. NO. 2,297,928

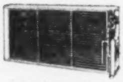
Save water! Save space! Save installation time and money! Save operating costs! Yes, install Governair and *save from $50 to $200 for each ton* of the completely packaged Governair unit designed to fit your needs!

Experience proves Governair can save you up to $5,000 on a 50-ton Governair unit that gives greater dependability and more "engineered efficiency" than ever before!

If you want the best — if you want the most economical and reliable air-conditioning unit on the market . . . CHOOSE GOVERNAIR and SAVE!

AIR CONDITIONERS




BLAST COILS FOR HEATING & COOLING

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

GOVERNAIR

UNIT COOLERS

GOVERNAIR CORPORATION • 513 N. BLACKWELDER • OKLA. CITY

producing relatively small amounts of condensate, such as sterilizers, laundry and dry cleaning presses, jacketed kettles, vegetable steamers, unit heaters, soap tanks, steam headers, risers, etc.

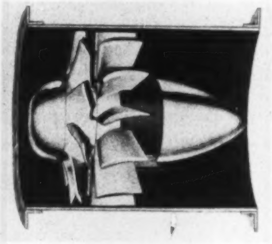
According to the manufacturers, the built-in strainer feature eliminates a separate strainer, extra fittings and installation labor. In addition, this trap is said to cost less than a comparable standard trap plus a separate strainer. It is offered with ½ or ¾ in. pipe size connections for 250 psig operating pressure, 769 to 1060 lb per hr continuous discharge hot condensate capacity. It has a cast semi-steel body and cap and an 18-8 stainless steel bucket.

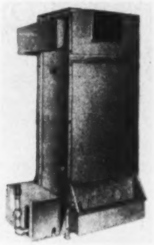
Vaneaxial Fans

HPAC 8—Propellair Div., Robbins & Myers, Inc., Springfield 99, Ohio, has added two new vaneaxial type, medium pressure fans to its line of commercial and industrial ventilating equipment.

Designed for ductwork applications, these fans permit series or straight-through connections. Supplementing airfoil section propellers, guide vanes are used to prevent swirling and to provide a smooth axial flow of air. According to the company, the fans operate on a low horsepower input and possess the ability to work quietly over a wide pressure range.

Positioned directly behind the blades, the guide vane is mounted independent of the welded steel drum. A spun aluminum nose and tail cone, providing the functions of streamlining the air flow, are contained within the distance between the two mounting flanges of a 30 in. duct section. Recommended for almost any type of ventilating requirement, the fans are available in both direct drive and belt driven models.


Vaneaxial Fan

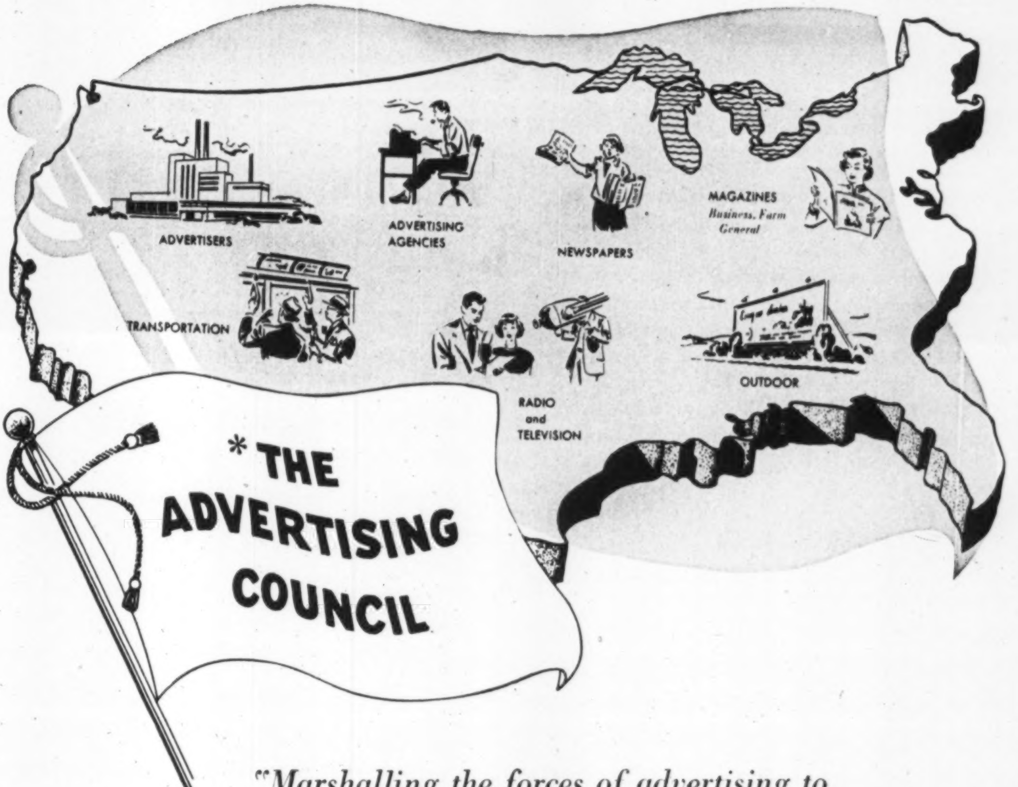

Water Cooler

Evaporative Water Coolers

HPAC 9*—Two completely new evaporative water coolers (TE-10 and TE-15), are now being produced for general distribution by Servel, Inc., Evansville, Ind.

The body and packing of both models are of asbestos cement sheets. From nozzles to sump, all parts used for assembly and operation are made of copper alloy, and the blower and frame are protected by hot-dipped galvanizing. The units are equipped with flue gas water treatment kits for eliminating scale forming properties of hard water.

The model TE-15 is said to evaporate a maximum of 15 gph and to be capable of cooling over 1000 gph (by a drop in temperature of 17 deg). Model TE-10 is said to evaporate a maximum of 10 gph and to cool over 650 gph. The new coolers are designed for use with the company's year 'round air conditioner and with the recently announced self-contained conditioner.



"Marshalling the forces of advertising to help solve national problems and to make democracy work better..."

Do YOU KNOW that the forces of advertising are engaged today in one of the world's greatest jobs of mass education ... *in the public interest?*

Do you know that these forces for good have been released through the vision and unselfish cooperation of American business – advertisers, advertising agencies, media owners and others?

Hundreds of advertising agencies have volunteered their planning and creative time and facilities. Artists, cartoonists, photo-engravers, printers, typographers and others have contributed their services.

Media owners have donated millions of dollars in space and time. National and local advertisers have sponsored and paid for many millions of public service advertising messages.

As a result, the American people are being alerted as never before to the dangers which threaten from within and from without ... the dangers of ignorance about our American economic system, intolerance, tuberculosis, school and teacher shortages, etc.

And, at the hub of this great public service effort is *your* organization ... The Advertising Council.

Advertisers and Media Owners ... Your Help is Needed!

Right now The Advertising Council has 14 programs in operation. The success of these programs depends on the public spirited and generous cooperation of advertisers and media owners. *Your* help, in the form of space or time donations, will mean a lot to us. And remember ... *What helps America helps you!*

Yours for the Asking

Write for a copy of Booklet No. 15. It will give you pertinent information about The Advertising Council ... how it started ... what it is ... what it does ... Or ask for material on specific campaigns. Address: – The Advertising Council, 25 West 45th Street, New York 19, N. Y.

THE ADVERTISING COUNCIL
What it is
What it does

Heating, Piping &
Air Conditioning
6 North Michigan Avenue
Chicago 2, Illinois

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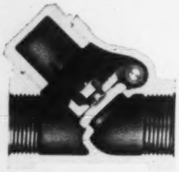
When a valve must make its own decisions use KENNEDY Swing Check Valves

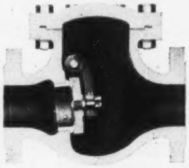
A swing check valve often guards the most vital point in your lines. That is why you will want the full assurance of KENNEDY'S seventy-three years of valve experience back of the check valves you select. When things are flowing smoothly . . . in the right direction . . . it stays open with minimum flow resistance. The moment back pressure develops it closes instantly and positively!

KENNEDY manufactures check valves in a wide range of types and sizes. Write for full details.



Kennedy Fig. 492-Bronze Swing Check Valve

Steam 300 lbs. at 550° F. Cold Water, Oil or Gas, Non shock, 600 lbs. Generous diameter cap permits easy inspection and regrinding without removing from line. Swing disc swivels in hinge while a stop on the cap prevents sticking in open position. Sizes ½"-3".

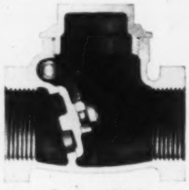


Kennedy Fig. 889-Iron Body Bronze Mounted

Bronze Faced Disc. Steam 250 lbs. at 500° F. Cold Water, Oil or Gas, Non-shock, 500 lbs. Revolving disc is self-adjusting. Angular placement permits easy opening at low pressures while also reducing closing shock at high back pressures. Sizes 2" to 10".

Kennedy Fig. 106-Iron-Body Swing Check Valve

Flanged; Bronze Mounted, Bronze Faced Disc. 2" to 12" Saturated Steam 125 lbs. Cold Water, Oil or Gas, Non shock, 175 lbs. Has revolving, self-adjusting disc angled for easy opening at low pressure and shock reducing closing at high back pressure. Sizes 2" to 24".



Kennedy Fig. 103-Bronze Swing Check Valve

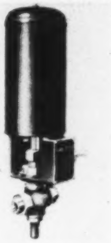
Bronze or Leather-Faced Disc. Saturated steam 125 lbs. Cold Water, Non-shock, 200 lbs. Also recommended for use on oil and gas lines. Leather-Faced disc should be used on cold water lines. Easy swinging disc is hinged on bronze pin . . . will not stick in open position. Sizes ¼"-4".

BUY FROM YOUR LOCAL DISTRIBUTOR

THE
KENNEDY VALVE MFG. CO.
1053 EAST WATER ST.
ELMIRA, NEW YORK
VALVES · PIPE FITTINGS · FIRE HYDRANTS

OFFICE WAREHOUSES IN NEW YORK, CHICAGO, SAN FRANCISCO · SALES REPRESENTATIVES IN PRINCIPAL CITIES

Hydraulic Motor Valve



HPAC 10*—Sarco Co., Inc., Empire State Bldg., New York City, has introduced a new electro-hydraulic motor valve for open-and-shut control (two wire, normally closed, for direct connection to 110 volts a-c, 60 cycle current).

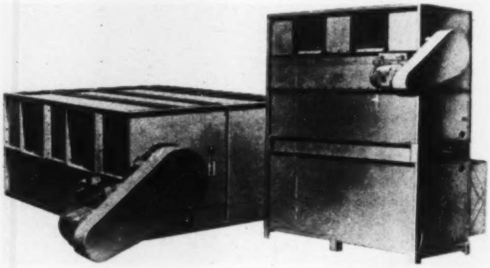
This valve is designed for automatic operation by thermostats, pressurestats or by liquid level or flow controls. As a shutoff valve in an inaccessible location, it can also be actuated by a push button. The "Sarcostat" valve is constructed to handle steam, water, oil, gas, air, etc., and is said to be an ideal valve for the remote control, by hand or thermostat, of steam or water branch mains for space heating systems.

The valve operator, actuated by hydraulic power, operates single seated valves up to 1½ in. or double seated valves up to 1 in. at 125 psi by direct thrust. When the full stroke is used, standard valves will open in 60 sec and close in 10 sec. Units are also available with an adjustable stop for partial throttling.

Valve bodies are of brass or iron with union or flanged connections. Various types of valve bodies are available: single seated, needle, piston or double seated.

Air Conditioning Units

HPAC 11—According to Young Radiator Co., Racine, Wis., the new YAC air conditioning line offers unusual versatility in application by virtue of sectional design—all units are shipped in sections unless otherwise specified. This is said to provide ease in handling, installing and servicing, as well as simplifying specification.



Units are stocked in eight sizes, horizontal or vertical types, and provide any combination of service desired, from simple heating and cooling to complete air conditioning. Capacities range from 400 cfm to 16,625 cfm under standard conditions.

Sectional design, says the company, contributes to low first cost and economical maintenance and all sections have been coordinated in a factory-built universal unit built and rated to exacting standards.

Large, Squirrel Cage Induction Motors

HPAC 12—Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee 1, has redesigned its standard line of large, bracket bearing, squirrel cage induction motors of four and more poles to provide more protection and greater accessibility.

.... the BEST BUY for

INCREASED ATTENTION
and
LASTING SALES POWER

THE JANUARY 1951 ISSUE

and 17th Annual Directory Number of

HEATING, PIPING & AIR CONDITIONING

DIRECTORY SECTION ....

Every product used in industrial and large building air conditioning, heating and piping will be listed. We'll tell who makes these products and their trade names. All advertisers as they appear in this Directory Section will be prominently identified indicating that more detailed information is elsewhere in the issue. It's the industry's best and most complete BUYING GUIDE—printed on colored stock in a special section.

SHOW SECTION ......

The January Number will preview the 10th International Heating, Ventilating, and Air Conditioning Exposition, Philadelphia, January 22 to 26. We will cover it completely . . . for those who attend, a *"where to go"* and *"what to see"* Guide—for those who can't go, the highlights of the show in print. Subscribers will get January HP & AC well in advance of the Show's opening date.

STANDARD EDITORIAL CONTENT ......

January HP & AC will be a "regular issue" in every respect. It will carry a full quota of timely articles, and the Journal Section of the American Society of Heating and Ventilating Engineers—the same as in every issue of this field-leading book. For extra attention value, it will have heavy covers, and be specially mailed.

Here's a regular issue, a directory issue, a show issue—all combined in one great January number . . . . and *no advance* over regular issue rates!

Here your advertising will get *increased attention*, and have *lasting sales power* (as catalog reference copy) throughout all of 1951.

Here is the "best buy" of the year in our field . . . . the place where a convincing sales story of your complete facilities will do you untold good.

Here is where *extra* space for *extra* emphasis belongs!

Most advertisers use increased space with us in January—spreads, inserts, color. They catalog their entire lines. You, too, can profit most by doing a complete job. Make space reservation now . . . . we'll be glad to help with copy preparation if needed.

Heating, Piping & Air Conditioning
6 North Michigan Avenue
Chicago 2, Illinois

GET THIS VALVE!

Accurate pressure regulation!

TYPE "C" STRONG VALVE

FOR HEATING OR PROCESS JOBS:

. . . with intermittent or fluctuating demand;

. . . requiring accurate control;

. . . where dependability is essential.

For positive control, use this STRONG* single-seated, pilot-controlled valve!

Simple design, extra-heavy construction make STRONG's Type "C" regulating valve give trouble-free regulation. Semi-steel for pressures to 250 psi, 450° F.; cast steel to 600 psi, 750° F. With Anum-Metl† seat and disc, this valve automatically adjusts itself to control the flow of steam, air or gas required to maintain reduced pressure.

Write us about your pressure reducing problem or request our complete steam specialties Catalog 68-H.

TYPE "O" Direct operated. Semi-steel construction suitable for initial pressures to 225 psi, 400° F. For steam, air, water or gas.

TYPE "K" Features internal strainer, Anum-Metl† seat and disc. Direct operated, of extra heavy semi-steel, this valve is suitable for pressures to 225 psi, 400° F.

*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY
1392 WEST 3rd Street
Cleveland 13, Ohio

† Anum Metl Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap

"SY" Strainer

800 Series Steel Trap

STRONG

Capsule type sleeve bearings are standard. The split, cast iron bearing capsule or housing has a machined flange for bolting to the bearing bracket. This permits removal of the upper half of the bracket for inspection or cleaning without exposing the inside of the bearing. Similarly, the air discharge openings in the side of the stator yoke, protected by removable louvers, facilitate vacuum cleaning or blowing out the air passages behind the stator core.

Since the only openings in the bearing brackets are in the air intakes near the bottom, the brackets afford protection for the ends of the motor. This construction, plus the use of louvered panels in the stator air discharge openings, makes the standard design drip-proof. Splashproof motors with internal baffling of air passages are also available.

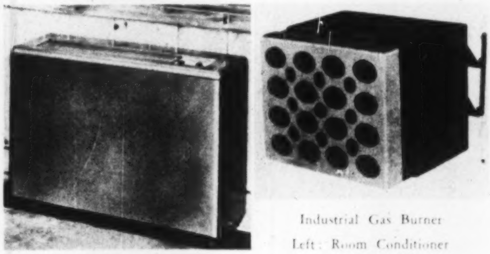
Bracket bearing, squirrel cage induction motor construction in this line is standard for ratings up to 1 hp per rpm. However, for steady, nonoverloading industrial drives (such as centrifugal pumps, blowers and fans) bracket bearing construction may be used for ratings up to approximately 1.5 hp per rpm for motors in the high speed class up to 900 rpm.

Room Conditioners for Central System

HPAC 13—Two new one-room air conditioners to be attached to a central system have been announced by Worthington Pump and Machinery Corp., Harrison, N. J. Known as the RVY series, the units are made in two sizes, the "300" and the "500". The volume of air handled by the smaller unit is from 200 to 350 cfm; for the larger, the range is from 350 to 600 cfm.

These conditioners may be furnished for direct expansion where there are only a few units involved or for chilled water for large installations. The chilled water cooling coils may be converted by a single switch to become heating coils and direct outside air may be taken through a filter or high pressure air may be supplied. The units may be automatically or manually controlled.

The conditioners essentially consist of the finned cooling and heating coils, a drip pan, a standard casing which may be omitted for concealed installations, two double width double inlet fans, fan motor, filter and insulation.



Industrial Gas Burner
Left: Room Conditioner

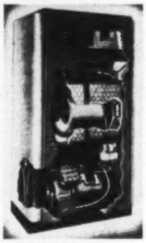
Industrial Gas Burner

HPAC 14—For installations requiring a horizontal gas burner, Iron Fireman Mfg. Co., 3170 W. 106th St., Cleveland, has developed the GCR series burner which is available in 18 sizes from 320,000 to 15,840,000 Btu per hr input.

The new unit is said to produce a "soft radiant flame" which is unusually short. This, says the company, is accomplished by two impinging gas jets which are introduced into each of 16 oval tubes in the face of the burner block in such a way that air and gas are rapidly mixed. In addition to primary air carried in through the oval tubes, there are nine secondary air openings in the face of the burner block, one of which may be used for insertion of a pilot light.

Packaged Air Conditioner

HPAC 15—An improved, self contained "Unitaire" air conditioner is now available from Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 36. It is designed to cool, dehumidify, circulate, and filter the air. Year 'round conditioning can be provided by the addition of either steam or water heating coils and an outside air duct connection for ventilation air supply.



The unit is a factory assembled, packaged conditioner with a hermetically sealed "Freon-12" compressor, water cooled condenser, direct expansion coil, and fan. It is offered in 2, 3, and 5 hp sizes and may be connected for single, two, or three phase operation on 50 or 60 cycle sources.

Centrifugal Fan Type Unit Heater

HPAC 16—A new blower type, gas fired unit heater, a modification of the recently announced fan type unit heater, has been added to the current line of Reznor Mfg. Co., Mercer, Pa.

Produced in eight different sizes, US-B heaters are practically the same as the company's fan type suspended heaters except that the propeller fan is replaced by a centrifugal blower. A belt drive is used on larger size heaters; direct drive with variable speed control is used on 50,000 and 25,000 Btu sizes. Other sizes have variable sleeve pulleys.

These new blower type heaters are equipped with summer and winter switches; are sound treated and cushioned in rubber and felt to deaden vibration; the blower assembly is rubber mounted; and an air seal of felt is used between the blower and heater.

Flow Control Valves

HPAC 17—A new addition to the line of hot water heating products of H. A. Thrush & Co., Peru, Ind., is the vertical flow control valve with air vent tube.

The device is designed for use on all automatically fired, forced circulated hot water heating systems and is designed to vent quickly all air that accumulates in the top of the boiler and to pass it directly into the pressure tank. The manufacturer states that the new valve not only puts air into the pressure tank where it serves a useful purpose but also makes unnecessary frequent venting of radiators, convectors, etc.

The new valve is similar to the angle type flow control valve with air vent tube introduced by the company last January.

INDEPENDENT

"Fabrikated" WALL GRILLES for Commercial Installations

PROVIDE ADJUSTABLE DIRECTED AIR FLOW

321-A

UP OR DOWN

RIGHT OR LEFT

311-A

Made to fit openings in even inches from 8" x 4" to 60" x 40"

Independent Fabrikated* Adjustable Grilles (patented), rigidly constructed with stamped steel rims and steel bars, are made with either vertical or horizontal grille bars. Grille bars are *adjustable* before or after installation; available also with bars permanently set for straight flow.

Write for new Catalog No. 50—gives schedule of sizes, details and prices.

Always Leading — Always Progressing

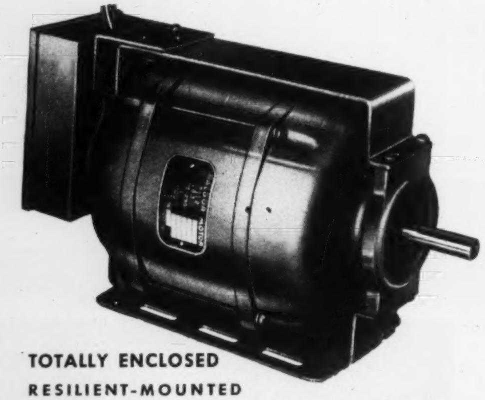
*Reg. U. S. Pat. Off.

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET · CLEVELAND, OHIO

BALDOR 4 Purpose Motor

for fan, blower and unit heater applications



TOTALLY ENCLOSED
RESILIENT-MOUNTED
BALL-BEARING, NEMA DIMENSIONS

BALDOR 4-purpose Motor for fan, blower and unit heater applications have these IMPORTANT FEATURES:

Constant speed:	115 volt
Two-speed:	115 volt
Constant speed:	230 volt
Two-speed:	230 volt

. . . quiet, vibrationless operation. Resilient Gimbal-mounted. Rubber-mounted knock-out box, insulated from motor frame, prevents transmission of noise and vibration.

. . . metal strap over motor prevents motor from springing out of cradle mounting rings.

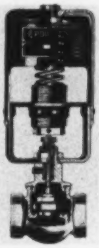
. . . motor operates with shaft either vertical or horizontal.

BALDOR ELECTRIC CO. • ST. LOUIS

Baldor

BETTER MOTORS FOR 30 YEARS

Air Operated Control Valve



HPAC 18—The new "Metaflow" air operated control valve for regulating the flow of steam, water, oil or gases is a diaphragm operated unit for pressure differentials below 75 psi. It is available in sizes from $\frac{1}{2}$ in. through 2 in. from Powers Regulator Co., 2759A Greenview Ave., Chicago 14.

The housing is aluminum alloy and the brass bellows is hydraulically formed. The adjusting screw is of brass with a rustproof steel spring having a 15 lb adjustment range to give proper sequence operation where required. The polished stainless steel stem in preformed lubricated metallic packing is said to insure long life and low hysteresis. Valve bodies are of bronze with screwed ends and a stem lubricator is optional. The trim incorporates a composition disc with brass integral seat and a self aligning disc holder.

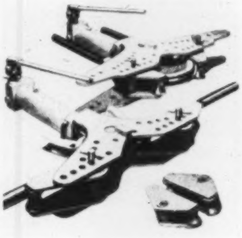
In addition to the standard valve, a packless valve body is available and is recommended for use with "Freon", oil, gasoline, noncorrosive gases, hot or cold water, and low pressure steam.

Pipe Bender for Radiant Heating

HPAC 19—Tal Bender, Inc., Milwaukee 2, Wis., is offering a new radiant heat attachment for its 2, 3 and 4 in. pipe benders for making 180 degree bends. According to the company, the many parts of which the attachment previously consisted and the different manipulations previously necessary have been eliminated by this new device.

The two wings necessary for making the 180 degree bends are now each one single unit, without any loose parts. A different frame makes it possible to put the pipe in the bender and, without any resetting of the wings, to make in one single operation 180 degree bends.

This new development is available with any desired standard center bending former, and is said to more than double the production in comparison to the previous device. If used with the motor attachment, bends can be made in rapid succession. The company is offering adjustments to present owners of the older radiant heat attachments.



Pipe Bender

Nut Running Tool

Impact Tools for Nut Running

HPAC 20—Ingersoll-Rand Co., 11 Broadway, New York City, is offering two new air operated "Impactools," the size 504 for nut running up to $\frac{3}{8}$ in. bolt size and the size 510 for nut running up to $\frac{3}{4}$ in. bolt size.

Both tools are of the pistol grip type, and are streamlined and balanced for ease of operation. The large, reverse caps are deeply grooved so the tools may quickly be reversed, even with greasy hands. Both tools are designed to provide a high run-down speed before impacting starts, and vane type air motors are said to give all the speed and power needed to handle difficult nut running jobs.

The Size 510 tool is a completely new size designed for jobs where it is convenient or necessary to have one hand free to hold the work or pick up the next nut to be run. The size 504 is a completely redesigned tool, 20 percent more powerful and 65 percent faster than the old model 504 tool.

Centrifugal Fan Ventilator

HPAC 21—The new "Airlift" centrifugal fan ventilator of Swartwout Co., 18511 Euclid Ave., Cleveland, is recommended for installations where powered duct exhaust ventilators operating at low noise levels are desirable.

The unit features a centrifugal type fan with backwardly curved blades, mounted within a weatherproof chamber. The streamlined fan bottom is said to increase efficiency while reducing turbulence to a minimum and to permit slow operating speed. The welded steel framework provides support for the unit which fits over the curb built to extend the duct rising from the building roof. Nearly 50 capacity variations are provided by the 14 sizes available.

Ventilator

Heat Transfer Surface

Heat Transfer Surface

HPAC 22**—Thermek Sales Co., P. O. Box 268, Whitewater, Wis., is marketing spined heat transfer surface in sizes up to and including 2 in. standard pipe size and of copper, steel, or aluminum.

According to the company, the surface is generally used in grid type construction with supply headers and return headers in multiple rows. The surface is said to provide unusual heat transfer either where the medium to be heated flows longitudinally through the tube itself or through the spines which are enclosed in a surrounding tube.

Piping Slip Joints

HPAC 23**—"Join-O-Seal" is the name of a new type of slip joint for use with high or low pressure gas, steam or fluid conductors. It is constructed with the familiar O ring used to provide a pressure seal on hydraulic parts and fittings. According to the manufacturer, Crabb Engineering Co.,

ONE PUMP BREAKDOWN CAN CRIPPLE AN ENTIRE PLANT!

Are your pumps DEPENDABLE?

In many plants, uninterrupted production depends on the continuous operation of *one* pump. If it breaks down — everything stops while repairs are made. Whole days of production may be lost if it has to be replaced. To avoid this expensive risk, employ only the most dependable pumps — WEINMAN.

Our representatives will be glad to size-up your present pump installations and to tell you if they are adequate for your needs. Each is a specialist in centrifugal pumps, their design, application, and installation. They can help you stop trouble before it starts. Why not write, wire or call a WEINMAN Specialist today and make sure that your pumps are dependable.

WEINMAN Type "U" Non-Clogging Pumps for liquids carrying solids. Capacities from 100 G.P.M. to 2000 G.P.M. Heads to 105 feet.

WEINMAN Type GB and KB pumps available with or without leak-proof mechanical shaft seals—capacities up to 1000 G.P.M. Heads up to 200 feet.

Representatives in Principal Cities

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SMALL PIPE
Threaded
IN A JIFFY

"RIDGID's my threader . . . threads 'em clean . . . threads 'em easy"
RIDGID
OO-R

Quick, perfect threads on 1/8" to 2" pipe with RIDGID Nos. 00R, 111R, 12R

● You get ready in a hurry with these light, strong ratchet drop-head dies—just snap in the size die head you want and you're all set for threading. Die heads can't fall out—no special dies needed for close-to-wall work. Precision-cut tool steel dies for smooth perfect threads. Ask your Supply House for work-saver RIDGIDs No. 00R, 1/8" to 1"; No. 111R, 1/8" to 1¼"; No. 12R, 1/8" to 2."

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

13594 Wisconsin Ave., Detroit 4, the rings are available in compositions to resist deterioration by contact with practically any element or temperature from –50 F to 300 F.

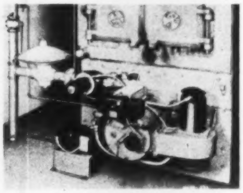
While primarily designed as a slip joint, it has been tested and used as a coupling, sleeve, union, swing fitting, rotatable seal-fitting and repair nipple. Joints are available in nominal pipe sizes in copper or brass from ½ in. up to 3 in., and may be ordered in special sizes. Advantages are said to include the fact that the joint occupies a space only slightly larger than the pipe, no soldering or tools are required to assemble the joint to copper pipe, standard copper-to-iron adapters may be used when using the joint for expansion or repair service to existing threaded iron pipe, and no locking device is required when used in anchored lines.

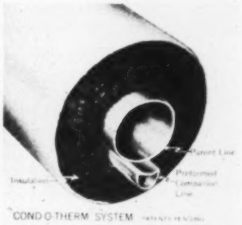
According to the manufacturer, the O ring assures leakproof sealing under all pressures within the limits of the conductor pipe. It is also said that alignment may be off as much as 15 deg from straight without affecting sealing or operation. In the illustration, standard copper pipe is shown at the left, the O ring in the center, and the slip joint with ring grooves is at the right.

Combination Gas-Oil Burner

HPAC 24—Changing from gas to oil (or vice versa) by throwing switches is one of the main features of the new "Flame King" series 116 DF packaged burner unit. This automatic dual-fuel unit is made in two sizes covering a range of 1½ million to 3¾ million Btu per hr input for industrial and commercial heating or processing boilers. It burns No. 3 oil, or lighter, and natural or mixed gases and is available from North American Mfg. Co., 4455 E. 71st St., Cleveland 5.

Factory wired and completely assembled, it includes electronic controls and the flame safety devices. An integral blower furnishes combustion air and an electrically ignited ignition blast pilot is included; together with gas regulators and oil pumping equipment.


Gas-Oil Burner



Right: Heating, Cooling Pipe Lines

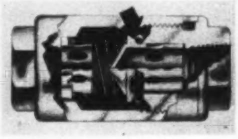
Maintaining Process Line Temperatures

HPAC 25—As shown in the illustration, the piping system of Cond-O-Therm, 18 Littleton Ave., Newark, N. J., has been developed to maintain predetermined temperatures at remote points in piping systems by using steam, hot water, brine, ammonia, "Freon" or any other heating or cooling medium in a preformed and extruded companion line.

According to the company, the companion line has a substantial surface area contact with the parent line and the relatively large heating or cooling surface in contact with the main line can be calculated accurately. The companion lines can be preformed from tubing of copper, monel, stainless steel or any metal required for the process. In addition, they can be furnished in multiples so that the parent line can, if necessary, be entirely clustered to maintain exceedingly high or low temperatures.

The system is recommended for maintaining preselected temperatures in piping carrying ice cream, chemicals, paraffin, fruit juices, milk, beer, etc. Complete systems, including insulation, are fabricated to order.

Check Valves



HPAC 26**—Now available from James-Pond-Clark, mechanical engineers of 1247 E. Green St., Pasadena, Calif., are "Circle Seal" check valves, offered as standard catalog items in pipe sizes 1/8 in. to 1 in.

The valve utilizes a synthetic rubber O ring between conical surfaces on the poppet and valve housing. As the line pressure works against the outer periphery of the O ring, increased line pressure increases the sealing pressure. According to the manufacturer, the ring provides only the sealing, the poppet load being carried by a metal shoulder in the valve housing. In the open position, the fluid flows around the streamlined poppet. The spring retainer, which serves as a poppet stop, is designed to allow full flow. The sealing principle is said to insure bubble-tight sealing against pack pressure, even with opening pressures as low as 4 in. of water.

The standard type valve is designed for working pressures of 0 to 3000 psi and the low pressure type from 0 to 1 psi. Working temperatures are from −65 F to 280 F, and valves suitable for temperatures up to 500 F can be furnished to order. The valve is recommended for use with air, gas, water, salt water and virtually all crude and refined petroleum products.

Arc Welding Process

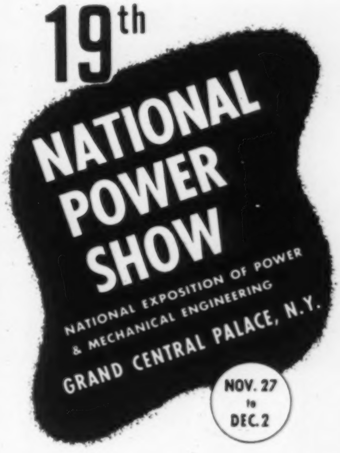
HPAC 27—According to Lincoln Electric Co., Cleveland 1, a new welding process employs welding current densities on 5/64 in. electrode wire which melt the electrode at speeds comparable to using 10,000 amp on a standard 5/64 in. diameter coated hand electrode. The new "Hidensity" process can be used with any standard company SAE 600 or SAE 900 welding generator or an SAE 600 gasoline engine driven generator.

The new process uses either a 3/32 or a 5/64 in. diameter electrode wire. Welding currents up to 600 amp produce high current densities which create a deeply penetrating arc which, in turn, allows the use of high welding speeds. This also means, says the company, that in general little or no edge preparation of joints is required, and therefore less weld metal is used in completely fusing the joint.

A "Manual Lincolnweld" ML-2 unit for using the proc-

Outstanding Opportunity!

A wealth of new and practical cost-saving ideas awaits YOU at this foremost display of steam, electric, and mechanical power equipment . . . .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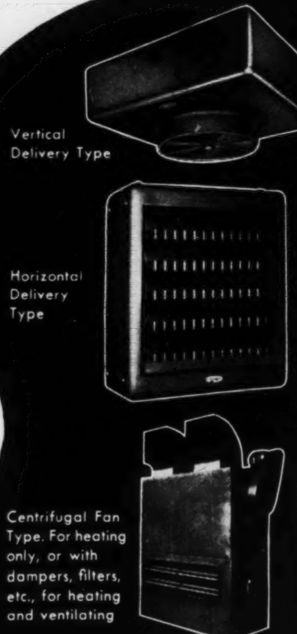
Steam Unit Heaters
SAVE FUEL . . . MEET EVERY SPACE HEATING NEED


Vertical Delivery Type
Horizontal Delivery Type
Centrifugal Fan Type. For heating only, or with dampers, filters, etc., for heating and ventilating

Insure complete heating satisfaction with Airtherm Steam Unit Heaters. The long life coils in Airtherm Unit Heaters have copper tubes and copper headers, brazed into an integral heat transfer unit.

Airtherm offers you Horizontal and Vertical propeller fan types for all commercial and industrial installations plus the Centrifugal fan type for handling large air volume, long heat throw and ductwork resistance.

For complete customer satisfaction, use Airtherm on your next job.

WRITE FOR BULLETINS No. 1208A and 402

AIRTHERM MANUFACTURING COMPANY

711 So. Spring Ave. • St. Louis 10, Missouri

ess may be connected to the firm's standard SAE 600 or 900 amp welding generator. It consists of a control case, wire reel case, conductor cable and welding gun. The control case contains a wire feed mechanism which automatically feeds wire at a preset arc voltage from the reel through the conductor cable to the welding gun. The wire is fed through the gun to the work and the gun holds inorganic granular flux which is deposited around the high density arc.

Zippered Cover for Pipe Fittings

HPAC 28*—Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa., has developed a new line of "Zipcoats" for protecting coupled pipe joints, welded joints, and insulating joints from corrosion.

The cover is placed over the joint and zipped. The end of the cover is turned back and a special sealing compound is applied underneath. This cements the cover to the pipe. In addition, the sealing compound is applied along the full length of the zipper and around the ends of the cover.

According to the manufacturer, these covers have high dielectric strength. Each contains an anaerobic microbiological corrosion inhibitor.

Pipe Fitting Cover

Temperature Indicator

Temperature Indicator

HPAC 29—A new device for measuring temperature by means of thermocouples has been developed by Kirby Walker, 7221 W. Madison St., Forest Park, Ill. It is a potentiometric D'Arsonval indicator, model 150. Designed to combine the advantage of the potentiometer with that of the meter which continuously floats the temperature on a dial, it is said to have many unusual features.

Weighing less than 20 lb, it incorporates a dial over 6 in. wide. There are three scales: 0 to 22 in millivolts, 0 to 2500 F for chromel-alumel couples, and −150 to 700 deg in Fahrenheit for copper-constantan couples. Readings are first taken by the null method, stopping the flow of the couple current and getting an accurate value. Following this, a float feature is available which then floats the obtained temperature on the dial. This is done with an adjustment on the panel which allows for the particular couple resistance connected. According to the manufacturer, the float feature is advantageous where the temperature is often changing and it is difficult to follow by the null method.

Room Cooler

HPAC 30—The new under-window room cooling unit of McQuay, Inc., 1600 Broadway, N. E., Minneapolis 13, is designed to dehumidify and cool in the summer and heat in the winter. It is available in three basic sizes and can be installed in either new or old buildings.

It is designed to filter its own outside and recirculated air and a damper permits individual control of outside air which is furnished either through pipes from a central blower system or from a rear or bottom connection directly to the outside through the wall or window.

All wiring and piping connections are concealed and units can be purchased without cabinets, for completely concealed installation. According to the manufacturer, the cooler is exceptionally quiet in operation.

We Hear That . . .

GENERAL ELECTRIC CO., apparatus department, Schenectady, N. Y., has formed a mobilization planning committee to coordinate requests from the Department of Defense and its agencies for information concerning facilities, personnel, possible production schedules and other matters of material procurement planning for national defense.

As part of the Economic Cooperation Administration's program to show modernized American industrial methods and procedures to Marshall Plan nations, approximately 50 persons representing 12 foreign nations recently toured the plants of *YORK CORP.*, York, Pa., and were told the important part that air conditioning and refrigeration play in the American way of life.

Completion of its 2000th centrifugal refrigeration machine (the large type unit used in air conditioning multi-room buildings and in industrial refrigeration projects) was recently marked by *CARRIER CORP.* with a production line ceremony at the company's heavy equipment plant in Syracuse, N. Y.

ARMCO STEEL CORP., Middletown, Ohio, will spend at least $15 million to modernize its Ashland, Ky., plant. A modern slabbing mill will be installed, along with other rolling and processing equipment necessary to produce steel coils 72 in. wide...... Marking its 15th year, *VIKING AIR CONDITIONING CORP.*, Cleveland, recently celebrated its anniversary with a family style party and open house, with 325 employees and guests in attendance.

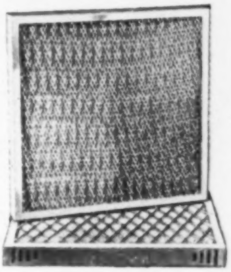
WARREN STEAM PUMP CO., INC., Warren, Mass., has purchased the *QUIMBY PUMP DIVISION* of *H. K. PORTER CO., INC.*, Pittsburgh. The Porter organization is withdrawing from the manufacture of screw pumps in order to concentrate on its other lines.

PERFEX CORP., Milwaukee, has expanded its Canadian company, *PERFEX CONTROLS, LTD.*, with a new manufacturing plant located at Guelph, Ontario. The new plant will be used for the manufacture of automatic controls and represents the first step in the company's Canadian expansion program which includes plans for the erection of two additional plants.

The Boston district office of *PENN ELECTRIC SWITCH CO.*, Goshen, Ind., has been moved to 313 Washington St., Newton 58, Mass. .... *FLEXIBLE TUBING CORP.* will move into its new 13,000 sq ft plant in Guilford, Conn., next month. The plant and office of the company are now located in Branford, Conn.

Airsan*
Air Filters
Trap More Dust

For Air Conditioning, Heating and Ventilating



Greater efficiency — lower resistance is yours with an AIRSAN Air Filter.

A permanent, cleanable viscous type filter of all galvanized construction, having full bronze welded corners. Expanded metal face plate acts as lint arrestor to provide easier cleaning and servicing. Rated filtering efficiency 98.5%. In standard 1" and 2" thickness.

Also available for heavy duty service on industrial and special applications — in 2" to 4" thickness. Holding frames (for V-type or straight banks) are made for all type filters.

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SHELL UNIT HEATER

Lee Shell Unit Heaters may be used singly or as a central system with the heated air distributed through ducts.
The efficiency of Lee Counter-current flow reduces fuel consumption while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges and provides ventilation without additional cost.

The **LEE** *line . . .*

Write now for more information

LEE ENGINEERING CO.
95 RIVER ST. HOBOKEN, N. J.

PENN ELECTRIC SWITCH CO., Goshen, Ind., is conducting a new series of educational shows as a service to heating engineers and service men. Created to give a visual demonstration in the use, construction, installation and servicing of automatic controls, the show began in Chicago last month, is now traveling throughout the midwest and north central states . . . . *HAJOCA CORP.*, Philadelphia, has moved its Staunton, Va., branch to new and larger quarters at 800 Greenville Ave.

HARTZELL PROPELLER FAN CO., Piqua, Ohio, has announced a $100,000 plant addition which will almost double the floor space of the main fan plant. The offices will also be enlarged and renovated. Replacing the gray paint previously used, a blue enamel is now being used on all fans and blowers manufactured by the firm. The new enamel is said to more than triple the protective qualities against abrasion and most acids and alkalies.

FLEXITALLIC GASKET CO., Camden, N. J., has added three new agents and one distributor to its field organization. *METROL CO.*, Detroit, is serving the entire lower peninsula of Michigan, including the Toledo area in Ohio. *POWER SPECIALTY CO.*, Houston, Tex., is the new distributor covering eastern Texas and western Louisiana, and *ILLES POWER CONTROL CO.*, Cleveland, is serving northern Ohio east of the Toledo area. *AIRDRAULIC EQUIPMENT CO.*, Buffalo, is the new agent in western New York, including the Syracuse area.

The industrial water treatment course of *POWER CHEMICALS DIV., E. F. DREW & CO., INC.*, New York City, consists of a series of lectures and discussion meetings covering the fundamentals of water chemistry and industrial water problems. It has been given in a number of eastern and midwestern industrial centers and will be given in Los Angeles the 17th and 24th of this month and in San Francisco on the 19th and 26th. The course will be conducted by Dr. R. C. Ulmer, technical director.

BLACK & DECKER MFG. CO., Towson, Md., has introduced carbon tipped blades for its line of "Quick-Saw" portable electric saws. The new blade is said to cut faster than abrasive discs when sawing "Transite," "Masonite," "Formica" and other abrasive or plastic composition materials. Available in 7, 8, and 9 in. diameter sizes, the new blades are said to be excellent for cutting wood.

RIDGE TOOL CO., Elyria, Ohio, is offering the "Ridgid" OOR-B bolt die, consisting of a ratchet drive ring and handle with 10 die heads fitted with ¼ to 1 in. button dies, both National Coarse and National Fine threads available. No adjustment is said to be needed for standard threads and adjustments for undersize or oversize threads may be easily made. The die heads are designed to fit the OOR pipe threader drive ring.

PRAT-DANIEL CORP., East Port Chester, Conn., is offering an induced draft fan stack which consists of a fan, breeching, and stack, integrated and installed as a unit. Units are recommended for providing induced draft for boilers in laundries, canneries, etc.

WHO'S WHAT

THE TRANE CO., La Crosse, Wis., has elected *MILES L. ERICKSON* and *THOMAS HANCOCK* vice presidents of the firm. With the company since 1935, Mr. Erickson has been located at the eastern manufacturing division convector plant at Scranton, Pa. He is the son of the late E. H. Erickson, one of the founders of the company. Mr. Hancock, who joined the organization in 1934 as an assistant in the advertising department, is now in full charge of all sales.

GUY L. BALDWIN, who has been with *ACME INDUSTRIES, INC.*, Jackson, Mich., for a number of years and has served in various administrative capacities and management functions, is now vice president of the firm. . . . . *PAUL S. PARK*, until recently manager of the engineering service department, A. M. Byers Co., has joined the staff of *C. A. HAWK, JR.*, consulting engineer, Pittsburgh. In his new association, he will handle assignments in heating, ventilating and air conditioning, including consulting work in the radiant heating and snow melting fields.

ERIC G. PETERSON has been elected to the board of directors and appointed vice president of *PEABODY ENGINEERING CORP.*, New York. In addition to his new duties, he will continue to serve as general manager in charge of both the New York office and the Stamford plant.

EDWARD E. GOULD, formerly assistant chief mechanical engineer, Albert C. Martin & Associates, has established a consulting engineering office at 672 S. Lafayette Park Pl., Los Angeles. His activities will include design and specifications for heating, ventilating and air conditioning systems. Mr. Gould is the co-author of an article on the air conditioning system in the Los Angeles municipal court building, published in the March issue of HPAC.

ROY W. MAZE has been promoted to the position of merchandising sales manager by *MARLEY CO., INC.*, Kansas City, Kans. He has been public relations director for the company since 1946.

IRON FIREMAN MFG. CO., Cleveland, has announced a number of personnel changes, following the death of President *T. H. BANFIELD*. Present officers will continue to serve under their present titles until the next annual meeting, and *E. C. SAMMONS*, a former director, has been re-elected to succeed the late president on the board. *FRANK S. HECOX*, general vice president and treasurer, is now "chief executive officer".

WOLVERINE TUBE DIV., CALUMET & HECLA CONSOLIDATED COPPER CO., INC., Detroit, has appointed *R. M. FRINK* as Detroit plant manager. Replacing him as customer relations manager is *V. A. ZATELL*, supervisor of the production planning department and a member of the divisional control group. *E. G. WOJACK*, who has been responsible for the coordination of production planning at the company's Decatur, Ala., plant, has taken over Mr. Zatell's former post.

"Slickest tool I ever used"

THE IMPROVED

Ramset Dual-Action

TAP IT . . .

OR TURN IT . . .

That's what both owners and operators say about the exclusive, new, TAP-TURN combination on the improved RAMSET DUAL-ACTION TOOL, for instant fastening into steel or concrete. Overhead, in floors, roofs, walls, and in tight spots, RAMSET seats the fastener in split-second time, with hair-splitting accuracy. TAP IT . . . OR TURN IT . . . whichever suits the job best. You save time, money, trouble with RAMSET DUAL-ACTION FASTENING TOOL.

Besides DUAL-ACTION, RAMSET SYSTEM gives you the shortest, lightest, strongest powder-actuated tool. Easy to carry, easy to use. Selected powder charges control penetration . . . no extra small parts needed. And, the greatest variety of steel drive pins and studs gives RAMSET wide versatility for fastening or anchoring work in steel, concrete, other building materials.

ASK FOR PROOF—IN 15 MINUTES

That's all your nearby RAMSET Specialist needs—15 minutes to demonstrate the outstanding features of RAMSET DUAL-ACTION and how they will slash fastening costs and get your work finished faster. Write or wire for details and demonstration.

Ramset Fasteners, INC.
Pioneer in powder-actuated fastening
12117 BEREA ROAD • CLEVELAND 11, OHIO

T. A. CRAWFORD is a new vice president of *TIMKEN-DETROIT AXLE CO.* and will continue as general manager of the Timken Silent Automatic Division of the organization. He has been with the company since 1926, when he started as a retail oil burner salesman.

ROBERTSHAW-FULTON CONTROLS CO. has added *ORLO E. BROWN, JR.*, research metallurgist, to the staff of its west coast research and development laboratory in Los Angeles. The author of many technical articles, he has served as metallurgist with A. O. Smith Corp. and as development engineer with Globe-Union, Inc. He also served as chief metallurgist at the Lockheed Aircraft Corp., plant A, and Western Gear Works.

ROGER S. AHLBRANDT has been appointed to the newly created position of manager of stainless steel bar sales of *ALLEGHENY LUDLUM STEEL CORP.*, Pittsburgh. Since 1948 he has been assistant manager of cutting tool sales and is now succeeded in his former position by *I. R. LEHENY*, sales manager of the San Francisco district office. *GUY M. WINTON*, of the San Francisco office, takes over Mr. Leheny's former position.

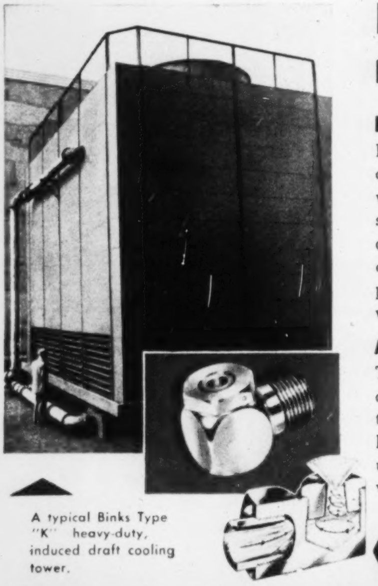
LEONARD E. BEES is now vice president in charge of manufacturing for *TRUMBULL ELECTRIC MFG. CO.*, Plainville, Conn. In this position he is responsible for the formulation of manufacturing policies and the conduct of all activities directly related to the manufacturing, packing and shipping of company products. He had been manager of manufacturing since August, 1949.

KENNETH W. LINEBERRY, who has been a member of the board of directors since 1946, is the new president of *BLACK, SIVALLS & BRYSON, INC.*, Kansas City, Mo. He was formerly vice president and a director of F. S. Yantis & Co. and now succeeds *A. J. SMITH*, resigned.

GLEN J. CHRISTNER, for the past year national sales manager of the storm window department, *EAGLE-PICHER SALES CO.*, Cincinnati, has been named general manager of the firm's insulation operations. He joined the organization in 1932 as New York district manager of the insulation division.

JOSEPH VARACALLI is the new dealer sales supervisor for the empire region of *ALLIS-CHALMERS MFG. CO.*, Milwaukee. He succeeds *J. R. QUEEN* who resigned to join the Columbia Machine & Engineering Co. Mr. Varacalli has been connected with the New York office since 1946, for the past several years as a sales representative. The region embraces district offices in New York, Buffalo, Newark, Rochester and Syracuse.

WILLIAM E. WALL is now in charge of the mechanical department of *RADER KNAPPEN TIPPETTS ENGINEERING CO.*, engineers and consultants of Miami, Fla. He was formerly with Gilbert Associates, Inc., Reading, Pa., and Maurice H. Connell & Associates, Miami, on various mechanical projects including heating plants, steam distribution systems, and ventilating and air conditioning systems.



A typical Binks Type "K" heavy-duty, induced draft cooling tower.

Clog-proof Rotojet nozzles are used in both the spray-filled and deck-filled towers.

For large scale water cooling...

Binks Type "K" Towers cut your costs

Eliminate costly water consumption

Let a Binks Type "K" heavy-duty, induced-draft tower cut your cooling-water costs by reducing water consumption to the minimum. The same cooling water is circulated over and over. A small power charge for pumping takes the place of a big water bill.

Assure better performance

Type "K" cooling towers give high cooling efficiency...the correct air to water ratio. They create their own breezes...are independent of natural air circulation. This is a big advantage in crowded locations. Binks Rotojet Nozzles insure correct fluid breakup for maximum heat dispersal.

Binks Type "K" towers are used extensively in connection with large-scale air conditioning, refrigeration, and related applications. They are made in a range of standard sizes in both deck-filled and spray-filled models. A Binks engineer will gladly help you solve cooling problems.

Send today for technical bulletins describing Binks Type "K" Induced Draft Cooling Towers. Ask for:

Bulletin 36—Type 2KS Spray Filled Cooling Towers (150 to 645 GPM)

Bulletin 37—Type 2K-W Wood Filled Cooling Towers (150 to 495 GPM)

Bulletin 39—Heavy-duty Type "K" Cooling Towers (1000 to 3000 GPM)

THERE'S A BINKS TOWER FOR EVERY COOLING JOB

Binks MANUFACTURING COMPANY

REPRESENTATIVES IN ALL PRINCIPAL CITIES ■ 3118-38 CARROLL AVENUE, CHICAGO, ILL.

A. M. BYERS CO., Pittsburgh, has named *W. J. BINDER* manager of the engineering service department. He has been with the organization since 1946. . . . . *MARLEY CO., INC.*, Kansas City, Kans., has established a Chicago sales office at 111 W. Washington St., with *ROBERT L. McFADIN* as district manager. The office will serve northern Illinois, northern Indiana and southwest Michigan. For many years, the Chicago area representative was the late *R. N. TURNER*.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Minneapolis, has promoted *MARTYN KINGSLAND* to commercial division sales manager for the northwest region and has promoted *STANLEY FURBER* to supervisor of instruments and zone control markets. Mr. Kingsland, who joined the company in 1934, has been located in various district offices, as well as the home office. Mr. Furber joined the firm in 1936 and has been in the Omaha and Kansas City offices.

GEORGE A. CHAPPELL, JR., with the Union Electric Co. for 20 years, has joined the *AUTOMATIC FIRING CORP.*, St. Louis, as assistant to the president. He will be in charge of production engineering. While industrial engineer for the electrical utility, he worked with many St. Louis manufacturers and has been closely associated with air conditioning developments.

J. F. PRITCHARD & CO., Kansas City, Mo., has opened a new district office in the Chrysler building in New York City to serve New York, Connecticut, New Jersey and eastern Pennsylvania. *A. B. McCLELLAND, JR.*, who recently joined the organization, is in charge. He was formerly sales engineer for M. W. Kellogg Co. and was sales manager for Project Engineering Co.

THOMAS I. BURBAGE, assistant to the vice president in charge of manufacturing, has been elected secretary of *BLACK & DECKER MFG. CO.*, Towson, Md. He succeeds *HARRY G. WHEELER*, who died last July.

C. N. SUGDEN is the new assistant director of engineering for gages and instruments and *ROBERT INGHAM*, succeeding Mr. Sugden, chief engineer for gages, according to a recent announcement by *MANNING, MAXWELL & MOORE, INC.*, Bridgeport, Conn. Mr. Sugden joined the company in 1920 in the drafting department and became chief engineer for gages in 1938. Mr. Ingham joined the company in 1941 as a development engineer.

DRAVO CORP., Pittsburgh, has opened a Boston sales office at 79 Milk St. for the sale of direct fired air heaters and crane cab conditioners. *R. M. BARNES*, northeastern sales and service manager of the company's heating department, is in charge of the office which will also serve Worcester county and the state of Rhode Island.

R. W. LAWINGER, president, S. J. Reynolds Co., Inc., has been re-elected president of the *HEATING, PIPING AND AIR CONDITIONING CONTRACTORS' CHICAGO ASSOCIATION*. *CHARLES E. CRONE* was renamed vice president, *C. W. JOHNSON* was returned as treasurer, and

Heating Surface

. . . . Long life and maximum efficiency depend on the amount of heat transfer surface. Olson, through the use of standard 10 gauge, 4" O. D. boiler tubes, gives even more effective heat transfer surface than the highest recommendation of accepted heating authorities.

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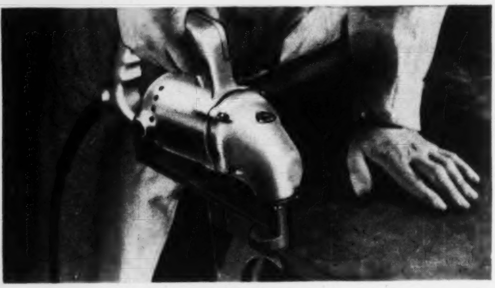

3 **BLACK & DECKER ELECTRIC PORTO-SHEARS*** cut sheet metal too tough for snips. Speed up jobs where snips are slow. Save you time and cut costs on hundreds of jobs. Fast, powerful shearing action eliminates hard muscular strain. Cutting operation *always* visible. Cut straight lines, irregular lines, curves to a minimum radius of ¾". Three models: 12, 16 and 18-gage capacity.

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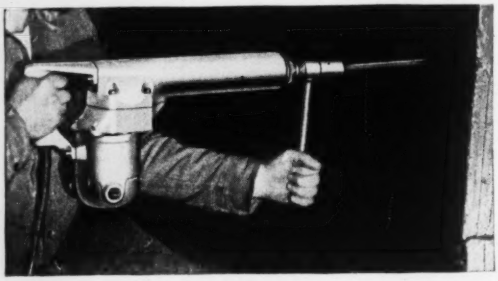

4 **BLACK & DECKER ELECTRIC HAMMERS** speed up such jobs as drilling holes for toggle bolts in concrete and brick—cutting mortar out of joints to install flashings—removing rust, weld spatter, old paint from sheet metal. High-speed, amazingly husky, deliver thousands of sharp, positive hammer blows per minute. Drive star drills, speed bits, chisels, many other tools. Light, compact, completely self-contained, require no transformer or extra equipment. Four models: rated by drilling capacity in concrete for ½", ¾", 1⅛", 2".

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BENCH GRINDERS

A. KILANDER was re-elected secretary. *JOSEPH S. KEARNEY* AND *W. S. BODINUS* were re-elected members of the board of directors and *THOMAS CUNNINGHAM* was appointed executive secretary, succeeding *LOUIS T. BRAUN*, retired.

LEROY J. KRANTZ, formerly manager of engineering installation and air conditioning sales for a refrigeration firm in Dayton, is now an air conditioning sales engineer for *FRIGIDAIRE DIV., GENERAL MOTORS CORP.*, Dayton. He will be assigned to various districts throughout the country on specific air conditioning projects where engineering assistance is required.

ALAN J. BRONOLD is now managing sales of *STERLING ELECTRIC MOTORS, INC.*, Los Angeles. He has taken over the duties of *ALLEN ADAMS* who, for a number of years, has headed up the company's international and domestic sales organization, and due to illness is stepping down from active sales management but will continue as an officer and secretary-treasurer of the firm. Mr. Bronold had been assistant general sales manager in charge of national sales for Sturtevant Div., Westinghouse Electric Corp.

CHARLES LOCKHART, JR., has been named assistant southern district sales manager of *BRYANT HEATER DIV., AFFILIATED GAS EQUIPMENT, INC.*, Cleveland, and will assist *J. H. SWALLOW*, southern district sales manager, in coordinating sales-promotional activity for the entire south. He had been manager, dealer sales department, general division, Lone Star Gas Co.

BALTIMORE AIRCOIL CO., INC., Baltimore, Md., has appointed four new exclusive representatives. They are: *MARSHALL, NEIL AND PAULEY, INC.*, 2711 Crocker St., Houston, Tex., covering the state of Texas, except the Amarillo and Lubbock areas; *NICK RUGE SALES*, of Lowell, Ind., for the central Indiana territory; *H. M. LUDLOW*, Jackson, Miss., for the state of Mississippi, with the exception of the northern and gulf counties; and *W. H. DUDLEY, JR.*, 340 Audubon Blvd., New Orleans, covering the state of Louisiana, except for the Shreveport area.

MAID-O'-MIST, INC., Chicago, has named *NORMAN F. SORGENFREI* as assistant manager of sales. He has a background of 15 years experience in the heating industry. Representatives recently appointed are *PAUL SIMMONS CO.*, 912 Commerce St., Dallas, handling eastern Texas, and *E. H. CULLEY*, 419 W. Main St., Louisville, covering the states of Kentucky and Tennessee.

AJAX FLEXIBLE COUPLING CO., INC., Westfield, N. Y., has appointed three new representatives. *SAMSON SALES CO.*, 420 Market St., San Francisco, is covering northern California. *J. S. THURLOW*, manager of *THURLOW EQUIPMENT DIV., G. DONALD BRADLEY CO.*, 1402 White Bldg., Seattle, is handling representation of all company products except flexible couplings in the states of Washington, Oregon and Idaho. *BOYD GOODHART*, 1425 Troost Ave., Kansas City, Mo., is handling the complete line in western Missouri and Kansas.

DR. ROBERT H. STEINER, who has been with Firestone Tire and Rubber Co. for the past seven years, is now research coordinator for *ATLAS MINERAL PRODUCTS CO.*, Mertztown, Pa. . . . . Industrial and air conditioning nozzle representation in the New England territory for *DELAVAN MFG. CO.*, Des Moines, Ia., is now being handled by *JOHN J. MADDEN*, 212 Madison St., Dedham, Mass. He has been handling the company's line of refrigeration parts.

H. K. PORTER CO., INC., Pittsburgh, has appointed *JOHN A. MULHEREN* to the newly created position of advertising manager. He will coordinate and supervise advertising and publicity programs of the parent company and its various divisions. He was formerly manager of sales promotion and market research for Chemical Engineering and Food Industries magazines.

C. H. BROWARD, 1022 E. Boulevard, Charlotte, N. C., is the new unit heater representative for *D. J. MURRAY MFG. CO.*, Wausau, Wis. His territory includes the states of Georgia, North and South Carolina and several counties in Tennessee. . . . . *WILLIAM R. FUNK* is the new southern regional sales manager for *ACME INDUSTRIES, INC.*, Jackson, Mich. He was formerly with Frigidaire Div., General Motors Corp., Carrier Corp., and Airtemp Div., Chrysler Corp.

Austenitic and Ferritic Steels Compared for Main Steam Piping

Thermal shock tests have been conducted at the U. S. Naval Engineering Experiment Station on 6-in. pipe and valve assemblies representing both austenitic steel, type 347, and $2\frac{1}{4}$Cr-1 Mo steels in 80 and 160 schedules. The nominal pipe-wall thickness for 80 schedule pipe is 0.432 in., and for 160 schedule pipe 0.718 in. Each assembly contained two valves, one cast and the other forged of similar composition to the pipe material.

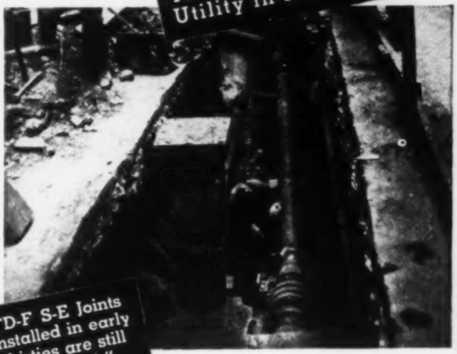
The thermal shock tests were designed to simulate the effect of carry-over of boiler feedwater into main steam lines operating at 900 or 2000 psi pressure, 1050 F temperature. The assemblies were shocked by introducing either 60 or 88 lb of boiler water at the saturation temperature along with the flow of super-heated steam. Each assembly was subjected to 100 or more shocks. Temperature differentials in the pipe walls showed that the maximum temperature difference between the inside and outside of the wall was obtained for the ferritic steel assemblies. Moreover, the maximum temperature difference occurred in a much shorter time in the case of the ferritic steel. All thermal shock specimens withstood 100 or more shocks without failure by rupture.

Other test procedures described include cyclic deflection tests of full size mock-ups consisting of 160 schedule pipe and valves for simulating expansion bends.

A report of the tests is contained in the paper, Thermal Shock and Other Comparison Tests of Austenitic and Ferritic Steels for Main Steam Piping, by W. C. Stewart and W. G. Schreitz, both of the experiment station. The paper is identified as No. 5-S-23 and was presented at the recent spring meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

WHY THEY CHOOSE
Badger
EXPANSION JOINTS

The largest operating Utility in New England



"D-F S-E Joints installed in early thirties are still on the job"

Back in the early thirties the now-famous Badger Directed-Flexing principle was added to the Self-Equalizing construction. The principle underlying the idea (see illustration below) looked sound to the Utility Engineers and several joints were ordered and installed in their central heating distribution system. Badger D-F S-E Joints are still on the job.

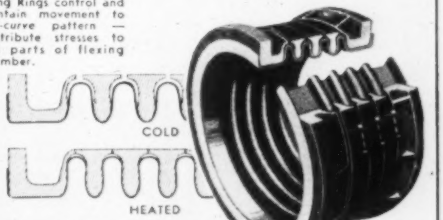
With this Utility, as with hundreds of others, Badger Directed-Flexing Self-Equalizing Expansion Joints are famous for performance. Reason? *Exclusive* construction features which guarantee longer life without maintenance. So be wise, figure in terms of *costs* and specify Badger Joints. Send for your copy of new 24-page catalog.

Badger Joints flex like this . . .

not like this . . .

***All-curve* flexing *guarantees* longer life**

EXCLUSIVE construction of Badger Joints eliminates localized flexing stresses that cause breakdowns, Directed Flexing Equalizing Rings control and contain movement to *all*-curve pattern — distribute stresses to all parts of flexing member.



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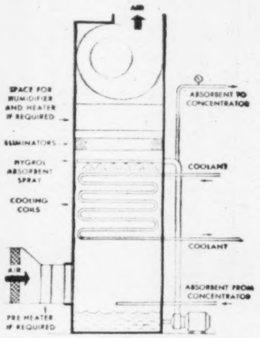
How You Save with the NEW Niagara Method of Air Conditioning

Using "Hygrol" Hygienic Absorbent Liquid

Because it absorbs moisture from the air directly, the new Niagara Controlled Humidity Method uses less, or no, mechanical refrigeration for dehumidifying. You save first costs and installing of heavy machinery. You save space, maintenance expense, power. Easier, convenient operation.


AIR
SPACE FOR HUMIDIFIER AND HEATER IF REQUIRED
ELIMINATORS
HYGROL ABSORBENT SPRAY
COOLING COILS
AIR
PRE HEATER IF REQUIRED
ABSORBENT TO CONCENTRATOR
COOLANT
COOLANT
ABSORBENT FROM CONCENTRATOR
NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

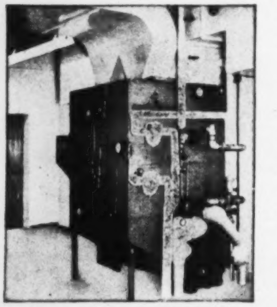
Using "Hygrol" hygienic absorbent liquid, this method gives complete control of temperature and relative humidity. Especially, it is a better way to obtain dry air for drying processes, packaging hygroscopic materials, preventing moisture damage to metals, and obtaining better quality for chemical process products and food products—or in obtaining better results in comfort air conditioning for office or laboratory at lower refrigeration costs.

The diagram shows how filtered air is dehumidified by passing thru a spray of "Hygrol"— a liquid absorbent which removes air-borne moisture. This liquid is hygienic and non-corrosive; it contains no salts or solids to precipitate and cause maintenance troubles. It is continuously reconcentrated at the same rate at which it absorbs moisture, providing always the full capacity of the air conditioner, automatically.

Units provide a range of capacities from 1000 to 20,000 C. F. M. Multiple unit installations are in use successfully. Records of results are available.

For further information, write to Niagara Blower Company, Dept. 405 Lexington Ave., New York 17, N. Y.

Food Packaging under Controlled Humidity


Niagara Controlled Humidity Air Conditioner

NEW BOOKS & REPORTS

Lists Equivalent Valves

Of interest to specifiers, buyers and users of valves, is a new manual, Equivalent Valves, compiled by H. Gordon Hawes. It embraces 175 pages of data and lists the valves of 18 leading manufacturers. All information has been checked by each of the manufacturers.

Basically it is a guide to the differences between the valves of these manufacturers for a given type, material, and pressure rating. In case a certain valve is in short supply or unobtainable, the listing shows which other valves are equivalent. Also when purchasing on an "or equal" basis, one may determine which valves are equal or equivalent. For example, in obtaining a 150 lb WSP iron body, OS & Y gate valve one turns to a given page and finds all the valves the manufacturers offer to that specification, with the individual variations in the standard design features, such as bronze or steel stems, bolted or clamp bonnets, integral or renewable seats, etc.

The manual is published by the Hooper Publishing Co., 545 Sansome St., San Francisco 11. The price is $15.00 and the book will be sent on approval, if desired.

Finds Dust Hazards From Grinding Operations Controlled

In his paper, Dust Hazards Relative to Grinding Operations, K. T. Benedict, medical director, Norton Co., concludes that dust hazards do exist in his company but are controlled by approved equipment and constant supervision by production department heads, assisted by the safety, medical, and engineering departments.

His paper reports results of a survey covering 32 men from 26 to 60 years of age exposed to dust hazards of grinding operations in the machine division of his company and two men working in a truing department of the abrasive division. The men operate a wide variety of grinding machines, and lung examinations, including chest x-rays, revealed no cases of tuberculosis, silicosis, or benign pneumoconiosis. Dust eye hazards were found to be present, but no severe injuries or prolonged disabilities were noted. Adequate eye protection, in the form of company furnished safety glasses, is urged, but not forced upon the worker. Dust counts were found to be consistently low, even for free silica exposure.

In addition to presenting the results of this survey, the author also reviews the potential dust problems arising in grinding operations generally and covers the causes of pneumoconiosis, or the so-called "dusty lung".

The paper, No. 50-F-8, was presented at the recent fall meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

Compares Types of Heat Pumps

In his paper, Heat Pumps, E. B. Penrod, department of mechanical engineering, University of Kentucky, Lexington, Ky., compares three distinct types of heat pumps which may be used for continuous air conditioning.

In 1834, Peltier found that when electric charges flow across the junction of two dissimilar metals they give rise to an absorption or liberation of heat. If electric charges flow across the junction in one direction heat is absorbed,

No Guesswork with

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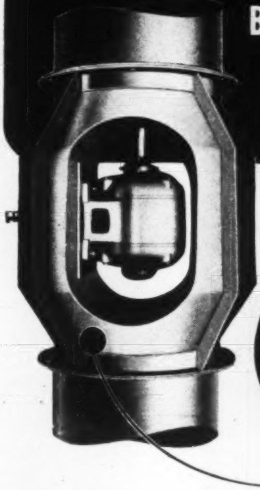
Induced Draft

BIFURCATOR FANS



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The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing, easily installed in vertical stack or horizontal or angular breeching. No special platforms or supports are required. Gases are by-passed around the motor, which remains cool, clean and easily accessible. Standard fan sizes 12" through 27", for boilers having nominal ratings up to 350 BoHP, or 49,000 square feet of radiation.

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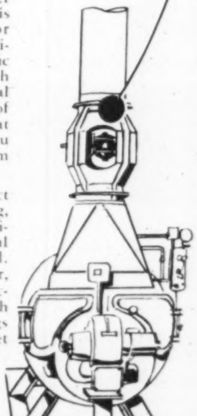

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AMERICAN MACHINE AND METALS, INC.
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STEAM GENERATORS

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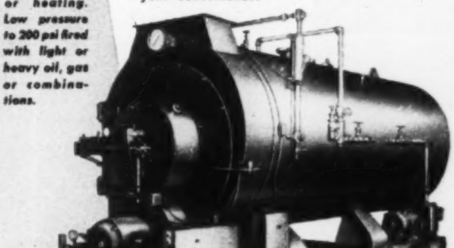
HAVE the REAL
*** ANSWER TO**
***Low* GAS and OIL**
CONSUMPTION

***WHAT IS IT?** It's the modern scientific discovery of transferring heat at the highest degree of efficiency with a new low in fuel consumption. Principal factors of which are the cylinderized solid flame with its exclusive cyclo-motion power, designed to utilize the full potential of every particle of fuel . . . and the thin layer of air resulting from centrifugal force that's always between the flame and wall of combustion chamber. A combination to produce steam far in excess of conventional standards for measured heating surfaces.

SEND FOR *ALL* THE BIG REASONS

Learn how the completely automatic Cyclotherm with its unexcelled all-in-one package type features wipe out waste and excess costs. If you are planning a new or replacement boiler installation it will pay you to first get the facts on Cyclotherm. The coupon below is for your convenience.

***SIZES** available to fit your steam or water load for processing or heating. Low pressure to 200 psi fired with light or heavy oil, gas or combinations.*



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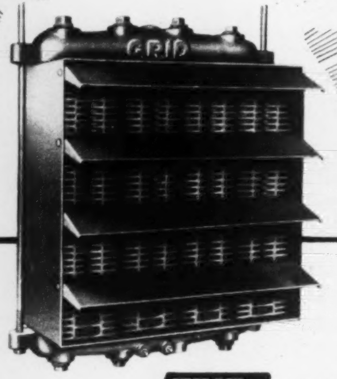

GRID high test cast iron construction withstands corrosive fumes.

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GRID will withstand steam pressures up to 250 lbs., and is free of electrolysis.

GRID design incorporating proper fan sizes, motor speeds and outlet temperatures results in a properly balanced heating unit, especially when high steam pressures are used.

GRID fins are cast integral with the steam chamber assuring even distribution of heat. It's not possible for GRID fins to come loose from the steam chamber to cause loss of heating efficiency.

No other unit heater incorporates these features that are vital to proper and efficient industrial plant heating.

INVESTIGATE today GRID systems of high pressure unit heaters, blast coils, and radiation . . . the answer to maintenance-free heating in the industrial plants.

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while if they flow in the opposite direction heat is liberated. In other words, when electric energy is supplied to a thermocuple it is essentially a heat pump capable of absorbing heat from one medium at a low temperature level and delivering heat to another at a higher temperature level. The Peltier heat pump was proposed nearly 60 years ago. However, a heat pump constructed from alloys available at that time would have a low efficiency. Recently, research has been done to develop new alloys which obey the Wiedemann-Franz-Lorenz law and at the same time have a higher thermoelectric power. It is pointed out that future research in metallurgy may produce alloys which will be malleable, have a very high thermoelectric power, and at the same time obey the Wiedemann-Franz-Lorenz relation.

In discussing the absorption heat pump, Mr. Penrod states that while it may have a low coefficient of performance, if perfected it would lower the annual operating costs as compared to the gas fired packaged air conditioner when used for continuous air conditioning, by reducing the gas consumption during the heating season.

The author presents a theoretical analysis for determining the performance characteristics of an earth-to-air and an air-to-air compression heat pump system. He states that a water-to-air heat pump system will have performance characteristics similar to those of the earth-to-air type and that the air-to-air heat pump requires a motor capacity about 50 percent greater than that required for an earth-to-air heat pump for heating the same structure under the same conditions. In his opinion, the condensing temperature of the refrigerant could be lowered if panel heating were provided. This, in turn, would increase the COP, decrease the compression ratio, and thereby decrease the horsepower of the compressor-motor. After stating that there will be practically no saving of our natural fuels if the heat pump is employed unless the COP for heating is above 3.33, Mr. Penrod points out that it might be possible to supplement an earth heat pump in the northern states and the air heat pump in the southern states with solar heat.

Published in the Transactions of the Kentucky Academy of Science, Vol. 13, No. 1, the paper has been reprinted in the form of a 37 page booklet.

Compiles Information on Heat Insulation

Heat Insulation, by Gordon B. Wilkes, professor of heat engineering, Massachusetts Institute of Technology, is designed to bring together in one volume some of the miscellaneous information on heat insulation. No attempt is made to produce a textbook, although the material should prove valuable to students of heat insulation. Since 1910, the author has been closely connected with the development and application of equipment to determine the effectiveness of heat insulation over a wide range of temperature.

One chapter is devoted to a brief discussion of various types of test equipment, some of which have never been publicized. In another chapter, the various factors that may affect the value of the coefficient of thermal conductivity are discussed in detail. The chapter on reflective insulation is based chiefly on work carried out in the heat measurements laboratory at MIT since 1929. Although no attempt has been made to cover the "unsteady" state of

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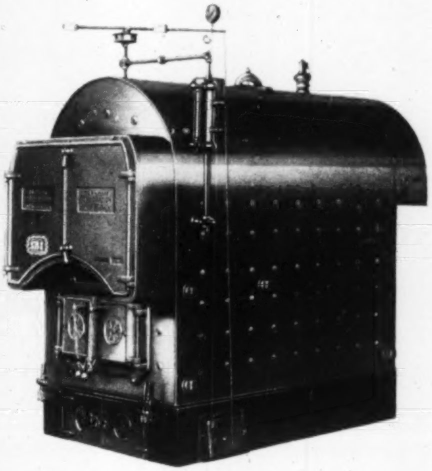

Large capacity in less space

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Capacities range from 3,000 to 35,000 square feet.

The famous Burnham fire travel, 3 times back and forth the length of the boiler, scrubs maximum heat from the fire. Quick steaming without priming. Low water line—easily installed. Adaptable for all fuels. Can be equipped with tankless or storage type hot water coils.

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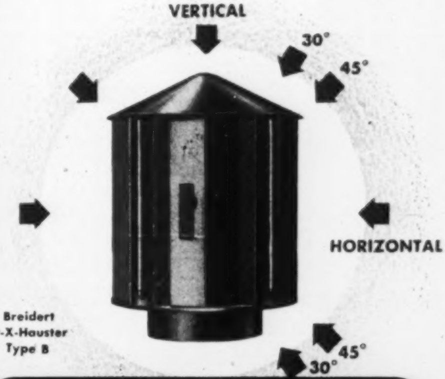
First Ventilator with Certified Capacity Ratings!



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Only the Breidert Air-X-Hauster offers certified capacity ratings based on tests* made with wind blowing in ALL directions as shown above. Only such tests can guarantee the capacities a ventilator will deliver under actual operating conditions! No matter which way the wind blows, barring interior negative pressures, the Breidert provides safe, sure ventilation.

For Chimney Tops . . . the Breidert Air-X-Hauster stops down-draft, exhausts smoke and fumes, completely overcomes sluggishness caused by down-draft. Thousands of Breiderts are in use all over the country.

For Vent Flues . . . the Breidert succeeds when conventional ventilators fail because it completely eliminates back-draft where no interior negative pressure exists. Positive flue action is assured regardless of wind direction. The Breidert is more compact and neat in appearance.

For Roof Ventilating . . . the Breidert is unsurpassed in efficiency, economy and appearance for use on residence, commercial and industrial buildings of all types. Stationary . . . no moving parts . . . nothing to jam or get out of order.

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heat flow, the chapter on specific heat and thermal diffusivity, as well as the tables in the appendix, were added because many of the values were determined under the author's supervision. The tables on coefficients of thermal conductivity in the appendix include most of the materials in common use.

The 224 page book is paper covered, is published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, and is priced at $4.00.

Ultrasonic Shear Waves Detect Flaws in Pipes

There are three major types of ultrasonic waves which can be used in flaw detection. Longitudinal waves are the most commonly used, and shear waves have only recently been applied to inspection problems. Surface waves have not as yet been commonly applied to routine inspection. Only longitudinal and shear waves penetrate into metal and become useful as a means of finding surface flaws. A longitudinal wave is one in which the particle motion in the medium is parallel to the direction of sound travel and a shear wave is one in which the particle motion is normal to the direction of travel.

The paper, Ultrasonic Flaw Detection in Pipes by Means of Shear Waves, by C. D. Moriarty, Schenectady works laboratory, General Electric Co., is concerned with the details in applying a shear wave to the practical problem of testing pipes. The author describes a procedure by which ultrasonic methods can be applied to the inspection of high pressure piping. A description of the equipment is included, together with some basic information by which the applicability to general pipe inspection can be evaluated. In the interest of accenting the application phases, a theoretical discussion of ultrasonic waves and their transformation has been omitted. Although this testing procedure is relatively new, the author believes that successful experience with it to date indicates its possibilities for providing additional insurance against hidden defects.

Presented at the fall meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, the paper is identified as No. 50-F-14.

Other Books and Reports Received

DATA ON CORROSION AND HEAT RESISTANT STEELS AND ALLOYS—WROUGHT AND CAST—An 84 page, paper covered bulletin available from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, for $2.50. These new tables of data bring up to date a previous compilation on wrought stainless alloys and include a comprehensive new section devoted to cast alloys.

SMALL PLANT MANAGEMENT—A 499 page guide to modern management techniques, published by McGraw-Hill Book Co., 327 W. 41st St., New York 18, and priced at $6.00. Prepared under the auspices of the American Society of Mechanical Engineers, this book shows how small plants fit into the economic picture, how they are set up and operated, and the overall opportunities for small plants. Edward H. Hempel, editor-in-chief and chairman of the ASME small plant committee, was assisted by 20 contributing editors.

Cliff
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CLIFF STEEL HEAVY DUTY HEATING BOILERS

- Heavy duty long life water leg construction. ✓
- Well constructed heavy flue doors and fire doors. ✓
- Extra wide firebox—lower draft loss through the boiler. ✓
- Constructed in excess of the A.S.M.E. code requirements—extra thickness firebox flue sheets on all boilers. ✓
- May be furnished in any size with an enameled steel jacket with two inch fibre-glass insulation. ✓

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Ratings from 320
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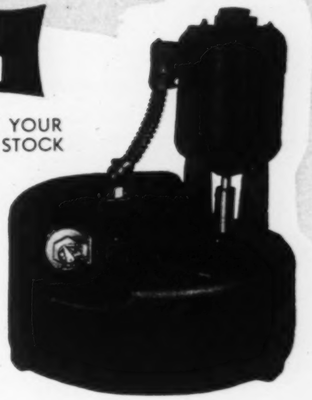

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Ball bearing—once a year lubrication	Ball bearing—heavy duty
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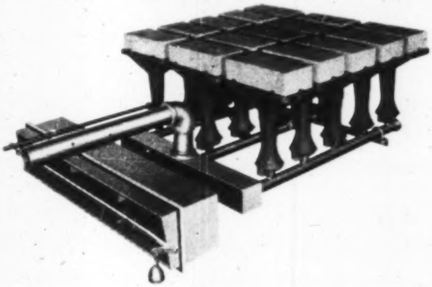

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- WILL NOT VIBRATE
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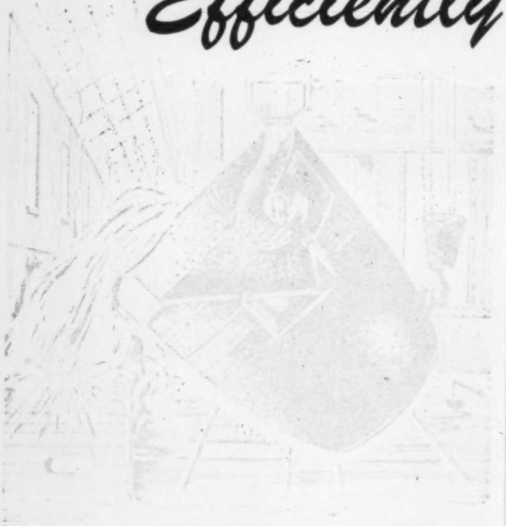

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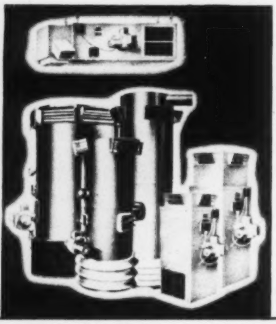

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Covers 1600 to 2400 sq. ft.

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Output 100,000 btu's hr
Covers 800 to 1200 sq. ft.

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Output 200,000 btu's hr
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MEETINGS & CONVENTIONS

I-B-R HEATING SCHOOL—Begun in Springfield, Mass., in April and sponsored by the Insitute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, a traveling school is designed to provide an intensive three-day training in heating design and installation. The instructor is Arthur L. Wales, field training director for the institute, and the tuition fee is $18.00. Classes will be held this month in Duluth, Minn., Davenport, Iowa, St. Louis, Indianapolis, and Chicago. Classes scheduled for November will be held in South Bend, Toledo, and Hartford, Conn., and similar sessions will be held during December in Worcester, Mass., and Bridgeport, Conn.

INSTRUMENTATION SYMPOSIUM—The Agricultural and Mechanical College of Texas, College Station, Tex., is offering its fifth symposium on Instrumentation for the Process Industries, October 11 to 13. The course will be conducted as a seminar with lectures and discussions on the measurement and control of temperature, pressure, liquid levels, time control, and allied subjects. Anyone living either in or outside Texas may take the course on payment of a $5.00 registration fee. Rooming accommodations and meals will be available on the campus. Further information may be obtained from Prof. P. G. Murdock, of the chemical engineering dept.

1950 *PUBLIC WORKS CONGRESS AND EQUIPMENT SHOW*—October 15 to 18, Ninth Regiment Armory, New York City. The 1950 Public Works Equipment Show will be held in conjunction with the 56th Annual Congress of the American Public Works Association, 1313 E. 60th St., Chicago 37. Frederick H. Zurmuhlen, commissioner of public works for New York City, is general chairman of the conference which will be held at the Armory and the Hotel New Yorker.

NATIONAL ASSOCIATION OF HOUSING OFFICIALS, 1313 E. 60th St., Chicago 37—The 17th annual meeting and the Building and Maintenance Products Exhibit, October 16 to 19, Detroit.

THE 38th NATIONAL SAFETY CONGRESS AND EXPOSITION, October 16 to 20, Chicago—Sessions on industrial safety will be held in the Stevens, Morrison, and Congress hotels. Additional information may be obtained from R. L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

NATIONAL NOISE ABATEMENT SYMPOSIUM—Armour Research Foundation, Illinois Institute of Technology, Chicago, October 20. The symposium will be the first national meeting of its kind and joint sponsors are the foundation and the National Noise Abatement Council. Among the papers scheduled for presentation is one on the control of noise in buildings by air conditioning, by C. M. Ashley, chief development engineer, Carrier Corp.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18.—The 31st annual meeting, the week of October 22, Sherman hotel, Chicago. Some 70 papers will be presented in 16 technical sessions, many of which will

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THE ECONOMITE
Residential size burner with all the famous design features of Lo-BLAST Burners.

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METAL PRODUCTS CO.
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Perfect Air Control with Ornamental Outlets

For air circulating systems in residences the dual-unit Hendrick Bulator is ideal. It provides complete control of air throw and spread, with a decorative effect that actually adds to the attractiveness of the room.

The installation shown is in the home of the president of a prominent corporation. Although the deflecting vane grilles of the Bulator are directly behind the Gothic Cloverleaf design of the ornamental grilles, only the latter are visible from the room.

For Bulator dual-unit installations a wide variety of ornamental grille designs are available, so one can readily be selected to harmonize with the decorative scheme of any room.

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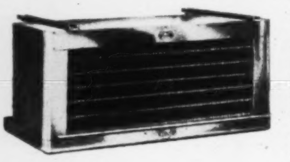
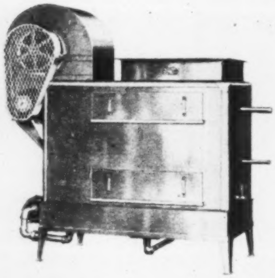
Ever since the inception of water defrost coils, more and more refrigerated warehouse owners have been installing them with amazing results. Positive temperatures below 34° for every type of application. Mounted near the ceiling, out of the way from valuable storage space. Recold low temperature coils provide the answer to many unusual storage and freezing room problems.



Illustrated at the left is the well known Recold water defrost coil, Model number 2700 LT. 285 of these are now doing an exceptional job of providing low temperatures in the world's largest warehouse, Alford Refrigerated Warehouses at Dallas, Texas.



Illustrated at the right is the "Recold" DRI-FAN Evaporative Condenser. This product is setting new records of performance and provides many years longer service because of a revolutionary development which keeps moist air away from the fan section, thereby eliminating rust and corrosion.

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RECOLD SUPREME, for storage of fresh meats, flowers and produce.

RECOLD TINYMITE, for reach-in refrigerators from 20 to 150 cubic feet.

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RECOLD FLOOR UNITS Standard water defrost for temperatures below 34°.

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AIR CONDITIONING EQUIPMENT For every installation.

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be devoted to specific industries. Other sessions will cover the latest developments and research and a third group will be devoted to general fields.

Four papers are to be presented during the session on pipe fabrication. They are:

Development of Welding Procedure for High Pressure, High Temperature Steam Piping, by N. L. Navarre, U.S. Naval Engineering Experiment Station

Fabrication and Welding of High Pressure, High Temperature Alloy Piping, by H. J. Irrgang, Jr., W. K. Mitchell & Co.

Design and Installation of Large Diameter, Long Span Welded Pipe, by Horace Jackson, Thompson Pipe & Steel Co.

Welding of 347 Stainless Steel, by R. W. Emerson, Pittsburgh Piping & Equipment Co,

The National Metal Exposition will be held concurrently at the Chicago International Amphitheater.

REFRIGERATION & AIR CONDITIONING CONTRACTORS ASSOCIATION, 228 N. LaSalle St., Chicago 1—The 5th annual convention will be held November 15 and 16 at the Hotel Lafayette, Long Beach, Calif. The affair will precede the west coast refrigeration and air conditioning conference and exhibit.

REFRIGERATION AND AIR CONDITIONING CONFERENCE AND EXHIBIT, sponsored jointly by the Refrigeration Equipment Manufacturers Association and the Refrigeration Service Engineers Society—The remaining three conferences in a series of four will be held November 17 to 19, Municipal Auditorium, Long Beach, Calif., January 26 to 28, State Fair Grounds, Dallas; April 6 to 8, Hotel Statler, Buffalo.

Additional information may be obtained from the REMA public relations department, 1346 Connecticut Ave., N.W., Washington 6, D. C.

REFRIGERATION SERVICE ENGINEERS SOCIETY, 433 N. Waller Ave., Chicago—The 13th annual meeting, November 17 through 19, Long Beach, Calif.

19th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, November 27 to December 2, Grand Central Palace, New York City—The show will be held in conjunction with the annual meeting of the American Society of Mechanical Engineers and, for the first time, will be under the auspices of the society. Show management is being handled by International Exposition Co., Grand Central Palace, New York.

A large number of exhibits will deal with fuels, fuel handling and combustion and a number will reveal improvements for the suppression of fumes and dust. Others will feature equipment for smoke and fly ash control.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—The 45th annual meeting will be held December 3 to 6, New York City.

NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 145 Public Square, Cleveland 14—The 37th annual convention, December 5 and 6, Hotel Statler, St. Louis.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1515 Massachusetts Ave., N.W., Washington 5, D. C.—The 117th meeting of the associa-

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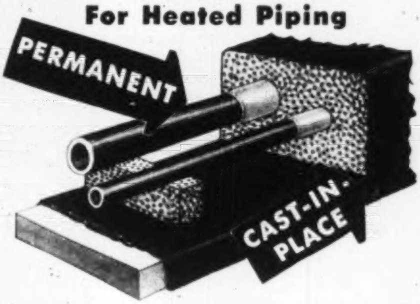
UNDERGROUND INSULATION
For Heated Piping



Check these 6 outstanding features of the Z-Crete system and see why Z-Crete provides the perfect answer for underground heated pipe insulation.

1. **More efficient** than most other methods. At least six inches of insulation around pipes. Solid monolithic construction eliminates heat losses due to air movement.
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3. **Gives added protection from moisture.** Monolithic, without joints or voids. Water is less apt to collect around pipes. Solid water repellent insulation restricts water movement. Z-Crete will not corrode embedded metal parts or pipe.
4. **Permanent.** Z-Crete will not rot, disintegrate or deteriorate if wetted. Resilient. Rodent—vermin proof—permanent as the earth itself.
5. **More adaptable.** Any size, number or arrangement of pipes can be insulated in one conduit.
6. **Requires no critical materials.** Z-Crete materials are readily available from plants in key locations throughout the country.

Z-Crete is a patented product, sold and installed only by licensed applicators. There is one near you. For his name, and further helpful underground insulation data, write

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Roof Ventilator

with certified fan ratings

for efficient
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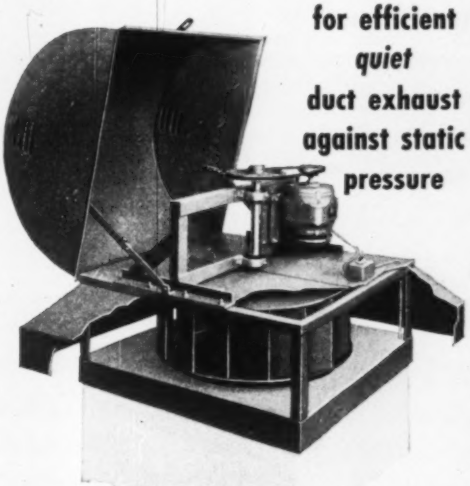

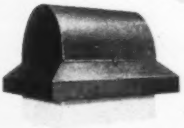

This new duct exhaust ventilator brings you the quiet ventilation you've wanted for offices, schools, recreation halls and other applications. Airlift is powered by an unusually efficient centrifugal type fan unit having a streamlined inlet. Other structural features maintain Airlift's air moving effectiveness while operating at *very low noise levels.*

Airlift is made in a range of sizes and capacities covering all usual requirements. Powered by high quality motor; ball bearing fan shaft mounting; easily accessible for servicing.

For complete description of this new Airlift, write for Bulletin 341F.

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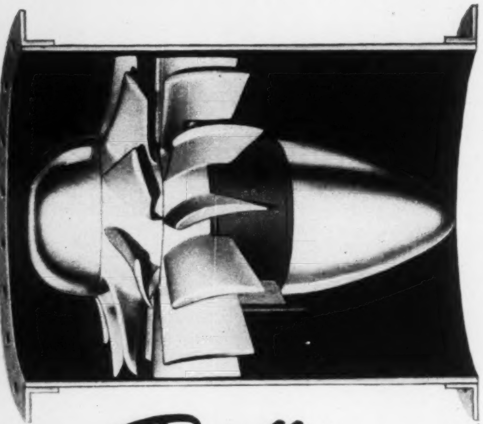
The Swartwout Co.
Industrial Ventilation Specialists Since 1904
Equipment for *Controlled* Air Circulation

A new peak in fan efficiency



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Give you *non-swirl* airflow

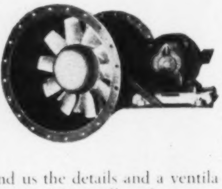
■ This new fan gives you 80% to 90% efficiency—far higher than most propeller fans. Its airfoil blade sections and airfoil guide vanes prevent air swirl, increase pressure.

Propellair Vaneaxial is a compact, self-contained drum unit that is easily installed in fresh air intakes, fume or dust removal systems, or other air ducts. This fan gives you rugged construction, low noise level, economical installation and operation.

Propellers and guide vanes are cast aluminum. Propeller shaft and motor have deep row ball bearings, for operation in any position. Standard NEMA motors on all connected models. Available in 20, 24 and 30 in. diameters—4,000 to 15,000 cfm, Certified PFMA Ratings.

BELT-DRIVEN DESIGN
(Motor outside airstream)

This type of Vaneaxial Fan is for use under conditions involving corrosive fumes, inflammable dust, or explosive vapors. Performance characteristics are similar to direct drive models.



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Our new Catalog H-785-P will give you full information on Propellair Vaneaxial Fans. Write for it. If you have a specific problem, send us the details and a ventilation specialist will make recommendations in your plant. There's no charge—no obligation. Write wire or phone us.

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tion will be held December 26 to 30, in Cleveland. All 17 of the association's sections and subsections and more than 40 participating societies and organizations are completing plans for an aggregate of more than 200 sessions. The annual Science Exposition will be held concurrently in the Cleveland Public Auditorium.

Housing will be taken care of by the Cleveland Convention Bureau, with hotels confirming reservations directly. Convention hotels include the Statler (AAAS headquarters), Hollenden, Carter, Allerton, Olmsted, and Auditorium.

PLANT MAINTENANCE SHOW and CONFERENCE, to be held January 15 to 18 in the Cleveland Auditorium. Advance registration cards and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, show manager.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 51 Madison Ave., New York 10—The 1951 annual meeting will be held in Philadelphia, January 22 to 25. Registration and technical sessions will be at the Bellevue-Stratford hotel, other meeting functions at the Benjamin Franklin and Warwick hotels.

10th INTERNATIONAL HEATING, VENTILATING AND AIR CONDITIONING EXPOSITION—Under the auspices of the American Society of Heating and Ventilating Engineers, the show will be held January 22 to 26, Commercial Museum, Philadephia. International Exposition Co., 480 Lexington Ave., New York City, is managing the affair.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—National meetings scheduled for 1951 are the spring meeting and committee week, March 5 to 9, Cincinnati, and the annual meeting, June 18 to 22, Atlantic City. The 1952 spring meeting and committee week will be held, March 3 to 7, in Cleveland and the 1952 annual meeting is scheduled for June 23 to 27 in New York City.

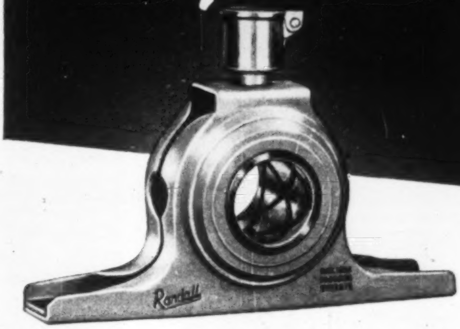
NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 919 Milam Bldg., Houston, Tex.—The 1951 conference and exhibition will be held at the Hotel Statler, New York City, March 13 to 16, and plans are now underway for the presentation of 39 technical papers.

AMERICAN INSTITUTE OF ARCHITECTS, Washington 6, D. C.—The 1951 convention and national seminar meetings will be held May 8 to 11, Edgewater Beach hotel, Chicago. For the first time in 83 years a product exhibition will be held in conjunction with the affair. According to the institute, only those building products or methods recently placed in production or shortly to be offered commercially will be granted space.

THE 7th ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION, to be held at Navy Pier, Chicago, November 5 to 8, 1951. The affair is sponsored by the Refrigeration Equipment Manufacturers Association, 1346 Connecticut Ave., Washington 6, D.C.

RANDALL BEARINGS

last longer run quieter



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STEEL FORCED WARM-AIR FURNACES
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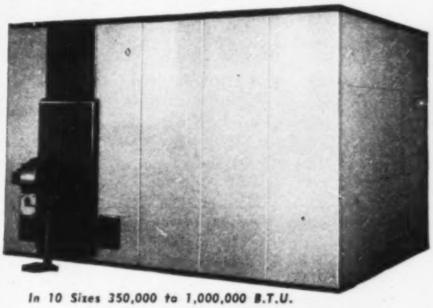

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Faithful Performance on Important Jobs

— such as water supply, brine circulation, booster service, white water and overflow, hot well, makeup water, etc., etc.

Capacities to 1,200 G.P.M.
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TYPE-AD Aurora Horizontally Split Case, Back-to-Back Impellers, Two Stage Centrifugal Pump. Particularly suited to clear water and low viscosity liquids not containing solids. *Write for BULLETIN 106*

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Large Processor Achieves

MORE UNIFORM HEATING CYCLES

with Nicholson Steam Traps

The positive action of Nicholson traps was recently used successfully by a chemical maker to smooth out the heating cycles of cookers at 50 to 60 minutes, against previous periods up to 105 minutes. Steam flow was upped to 3000 lbs. an hour against 2000 for the previous mechanical type.

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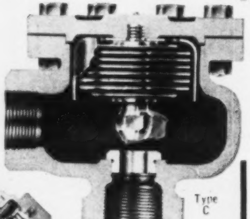
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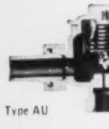
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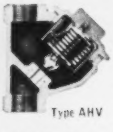
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RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 179. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air Compressors

HPAC 100—Ingersoll-Rand Co., 11 Broadway, New York 4, is offering a new bulletin describing its series T stationary air compressors. The series consists of two lines, one designed for normal industrial pressures of 100 to 125 psi, the other rated at 200 psi for continuous service and up to 250 psi on intermittent pump-up service. Both lines are available as tank mounted, baseplate mounted or bare units, with electric motor or gasoline engine drive.

Air Diffusers

HPAC 101—A new six page folder on aspirating air diffusers is now available from Anemostat Corp. of America, 10 E. 39 St., New York City. The folder covers the background and development of the company's diffusers and gives detailed information on the principle of operation.

Air Relief Traps

HPAC 102—Ball float traps for venting air from any liquid under pressure are described in a two page bulletin recently issued by Armstrong Machine Works, Three Rivers, Mich. Included are hook-up diagrams, cross sectional drawings of the traps, and physical data and list prices of cast semi-steel and forged steel traps; both direct lever action and spring loaded snap-action types.

Aluminum Finishes

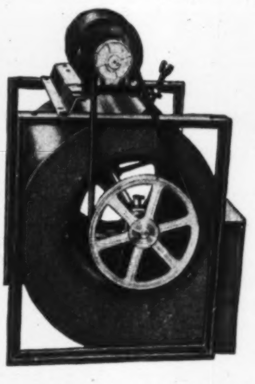
HPAC 103—The 1950 edition of Finishes for Aluminum is now off the press and may be obtained by writing on your company letterhead to Reynolds Metals Co., 2500 S. Third St., Louisville, Ky. It includes information on 10 cleaning treatments, 15 mechanical finishes, 16 chemically produced finishes, 11 electrolytic oxide finishes, etc.

Centrifugal Fans, Unit Heaters

HPAC 104—The Vol. 14, No. 4 issue of the house organ published by The Trane Co., La Crosse, Wis., introduces the company's new centrifugal fans, gas fired unit heaters, steam unit heaters, and adjustable diffusers for unit heater application. In addition to covering design and construction features, the bulletin includes fan performance curves and a number of unusual photographs showing smoke tests of the diffusers.

Centrifugal Fan Type Unit Heaters

HPAC 105—Airtherm Mfg. Co., 700 S. Spring Ave., St. Louis 10, has issued Catalog 402 on its line of centrifugal fan type unit heaters. Two or three double inlet, double width fans are mounted on the blower shaft and three types of coils (hot water, standard steam, and steam distributing tube type) are available. Capacities range from 95,000 to 1,500,000 Btu per hr.



THE NEW UNIVERSAL TYPE "N" BLOWER

MASSACHUSETTS . .

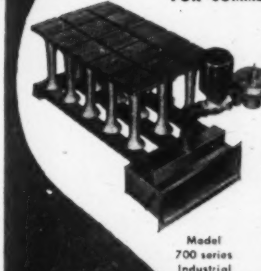
By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

WRITE FOR BULLETIN No. 110 CATALOG

MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO

BETTER BURNERS ARE MADE . . Reinhards MAKE THEM!

Reinhard
GAS CONVERSION BURNERS
FOR COMMERCIAL INSTALLATIONS



Model
700 series
Industrial

The Reinhard line includes:

Industrial gas conversion units that will fit practically any installation requiring from 60,000 to 3,000,000 BTU input . . .

Commercial units for restaurant ranges and Arcola type boilers . . . Utility conversion units for small commercial installations . .

Domestic conversion units for practically all types of home heating.

Manufactured since 1932

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AIR-FLO
AUTOMATIC
CEILING SHUTTER
FOR ATTIC FAN

Built so they can be installed practically flush with the ceiling, AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 72" long. No operating mechanism shows. Built-in fusible link. Meets fire underwriters requirements.

WRITE FOR NEW CATALOG 43-D

Illustrations and details of the complete AIR-FLO line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. · DETROIT 16, MICH.

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HUMIDITY RECORDER

Check condition and distribution of air in various parts of the building with Bristol's handy Portable Humidity and Temperature Recorder. Used in hundreds of institutions, factories, office buildings, etc., to give a continual, visual picture of humidity and temperature. Easily carried, set on table or hung on wall.
Immediate delivery from stock.

BRISTOL

A COMPLETE LINE OF AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS FOR AIR CONDITIONING

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FLORITE Direct-Reading AIR VELOCITY METER

RANGE 0-1000
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0 100 200 300 400
700
800
RANGE 0-1000 FT./MIN.
REPRODUCTION OF SECTION OF SCALE IN INSTRUMENT
Approx. ½ size, and as it would appear if straightened out

- *A practical, accurate air velocity meter for heating, air conditioning, and ventilating work. Indispensable for measuring grille velocities and air deliveries from registers and grilles; for balancing forced air heating systems, and for checking air distribution of all kinds of ventilating systems*
- *Accurate velocity readings, automatically averaged over a 3" dia. free area, instantly indicated in feet per minute.*
- *Extension handle facilitates positioning of instrument away from the observer for readings in hard-to-reach locations, or where the observer's body would interfere with the normal air movement.*
- *Unique scale lock makes possible to retain scale reading when desired until the lock is released—an indispensable feature where extension rod is used to position instrument away from the observer.*
- *Leather case is furnished as standard equipment for added protection when the instrument is not in use and for convenience when carrying it in the pocket.*

Ask your Jobber for the FloRite or write for Leaflet 760.

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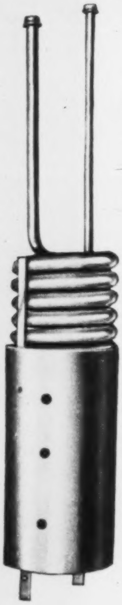
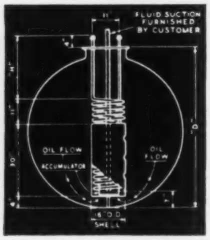
All-steel shell and coil assembly for preheating No. 5 and Bunker "C" oils to proper flow temperature in bulk storage. Suction pipes, inlet and outlet pipes for heating go through manhole cover.



POSITIVE PREHEATING

Heats with either steam or hot water. Oil or other liquids enter preheater from the bottom and pass over coils into flow accumulator before entering suction line. Connections furnished for any diameter tank. Made with 14" and 16" diameter shell.

Write — wire for full details.



REMPE COMPANY
342 N. Sacramento Blvd., Chicago 12, Ill.
"Manufacturers and Designers of Heat Transfer Equipment"

Centrifugal Pumps

HPAC 106—The new self priming centrifugal pumps of Goulds Pumps, Inc., Seneca Falls, N. Y., are designed to eliminate valves yet give efficiencies comparable to standard centrifugal pumps. Bulletin 636.1 gives information on pumps ¼ to 5 hp, with both open and closed impellers. Capacities range to 120 gpm and heads to 135 ft, depending upon the capacity.

Compression Fittings

HPAC 107—Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa., has issued a 12 page catalog on its complete line of compression fittings for copper tubing and steel pipe. These fittings employ the same principle as the company's couplings. Featured in the catalog is a two page spread which illustrates 12 applications where these fittings are said to give unique performance.

Conditioning Units for Large Buildings

HPAC 108—The remote room air conditioner, type AD, of General Electric Co., 5 Lawrence St., Bloomfield, N. J., is described and illustrated in a new four page catalog. Features are covered, specifications summarized, and dimensions given. Features are said to include provision for automatic control, finned coils for use with chilled or hot water or "Freon" (a combination "Freon" and steam coil is available), two 5 in. double inlet centrifugal fans, air filters, and provision for supplying ventilation air.

Convectors

HPAC 109—Catalog 702 of Airtherm Mfg. Co., 700 S. Spring Ave., St. Louis 10, covers design and construction features and gives data on dimensions, piping connections and capacities of convectors which are recommended for use in schools, institutions, apartment homes, offices and public buildings.

Cooling Towers

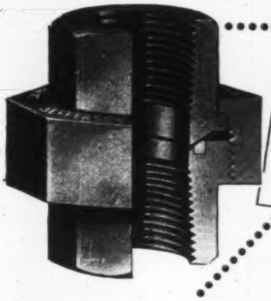
HPAC 110—Bulletin 5.9.081 of J. F. Pritchard & Co., 908 Grand Ave., Kansas City 6, Mo., covers series SRF cooling towers. Featuring redwood construction, units are specially recommended for air conditioning installations and are available in sizes from approximately 3 to 25 tons.

Cooling Towers

HPAC 111—Bulletin No. 40-A and data sheet No. 40-B cover the induced draft cooling towers of Acme Industries, Inc., Jackson, Mich. Design and construction features are described and dimensions, motor data, and ratings are tabulated. Capacities range from approximately 9 to 70 tons.

Electric Radiant Heating

HPAC 112—"Heatsum" electric cables are recommended for installation in floors and ceilings in connection with radiant panel heating. L. N. Roberson Co., 1539 E. 103rd St., Seattle 55, has recently issued new specifications and installation instructions which give detailed information on the cable and control equipment, electrical ratings, spacing between turns, shortening of heating elements, and testing and inspection. Installation recommendations are given for both ceiling and floor installations. Applications are illustrated.



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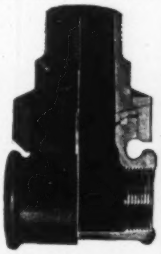
Close fits are simple with Jefferson Unions . . . and once in they'll STAY in because we make them from a very fine malleable iron with a tensile strength of 55,000 lbs per sq in. Details such as the machining instead of casting the ring channels . . . making the rings from special tubing instead of casting them and testing all fittings with air before delivery all add up to a minimum of maintenance after the installation. You're sure the job's in to stay when the joints are made with Jefferson Specialty Unions.



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MODEL NWDH for Controlling Air Conditioning Systems!

The Type NWDH dual switch thermostat with remote bulb for duct mounting is being used in applications in which it is desired to handle two electrical circuits from a single thermal assembly. Typical installations include the control of two compressors, one for normal operation and one for peak loads; or a fan and a compressor.

Standard switches are rated at 15 amps 125/250 V. AC. Switches rated at ¾ hp 125 V. AC, 1½ hp 250 V. AC are also available.

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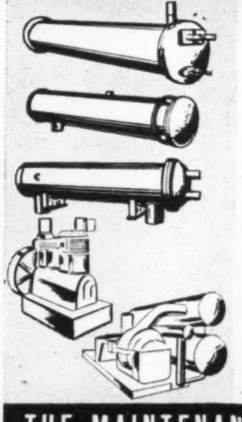

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NEW CONVERSION BURNER

A conversion burner with many new features at an economical price offering maximum efficiency.

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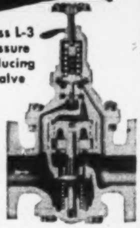

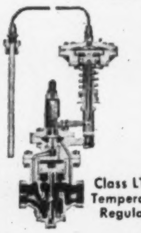

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Write Dept. HP for free Catalog on any of the above items.

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Representatives in all principal cities.

Fin Tube Radiation

HPAC 113—Slant-Fin Radiator Corp., 5113-17 Second Ave., Brooklyn 32, has issued a data sheet giving roughing-in dimensions and list prices on its slanted, fin tube radiation, sloping top and flat top convector covers and expanded metal covers.

Framing Structures, Hangers, Supports

HPAC 114—Channels and special fittings of Unistrut Products Co., 1013 W. Washington Blvd., Chicago 7, are briefly described in a new folder which covers the company's methods for the construction of frames, hangers and supports for electrical equipment, piping, and heating and air conditioning equipment. Numerous applications are illustrated, including shelving and storage racks.

Heat Exchangers

HPAC 115—A new price list (No. 103) of Heat-X-Changer Co., Inc., Brewster, N. Y., covers the various types of coolers, including heavy duty liquid coolers (for use where the outlet water temperature is 40 F or higher) and heavy duty coolers with circulating pumps for use where outlet water temperatures are 25 to 40 F. Also covered are combination air and water cooled condensers, remote type combination condensers (complete with fans and motors), water cooled condensers, tube cleaners, heat interchangers, shell and tube type condensers of 15 to 100 ton capacity and shell and coil condenser receivers.

Heating Make-Up Air

HPAC 116—Make-up air to replace exhausted air and balance minus pressures is the subject of Bulletin 502 released by New York Blower Co., 32nd St. and Shields Ave., Chicago 16. The company's unit consists of a heating element, fan, motor with adjustable speed v belt drive, and housing. It is described and illustrated and detailed information is given on component parts and accessories.

Horizontal Rotary Oil Burner

HPAC 117—The latest bulletin (No. 175-D) describing the horizontal rotary oil burner of Preferred Utilities Mfg. Corp., 1860 Broadway, New York 23, is now off the press. It has been brought up to date and gives detailed explanations of the dual pump reservoir, the patented "Voluvalve" fuel regulator, the high speed belt drive, which is designed to permit fully automatic operation with No. 6 oil, and other engineering features.

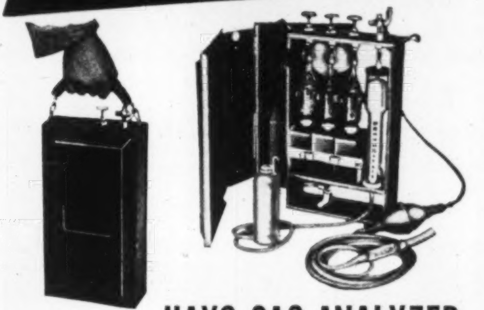
Nickel-Chromium Steels

HPAC 118—International Nickel Co., Inc., 67 Wall St., New York 5, has prepared Bulletin NS-2 on nickel-chromium steels (type 3100 series). Charts and tabulated data give information on chemical composition ranges of standard grades, critical ranges and maximum safe tempering temperatures, suggested annealing treatments, core tensile and impact properties for carburizing grades, tensile properties, and torsional properties.

Obtaining Government Business

HPAC 119—Trilane Associates, Inc., 1 Hudson St., New York 13, has published a 16 page brochure as an aid to manufacturers in obtaining government business. The booklet is divided into a number of sections, each dealing with different aspects of procurement. An introductory section explains various methods of government procure-

It's PORTABLE!



HAYS GAS ANALYZER

The Hays gas analyzer (or Orsat) tells if oil burner or stoker is properly installed—or if combustion is at maximum efficiency. Gives *accurate* readings of draft, CO_2 and flue gas temperature. Available in several styles from the single to the multiple chamber model shown which analyzes CO_2, O_2 and CO. All sizes available from stock. Write for helpful literature . . . FREE!

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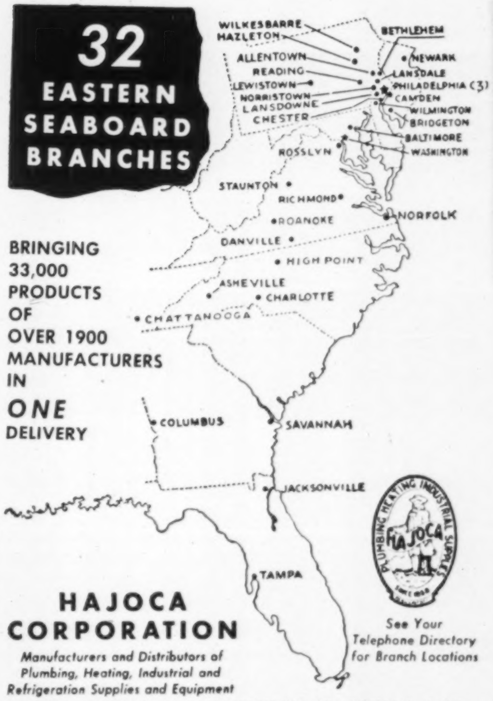

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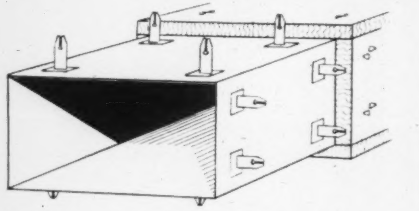
For Insulation Application on Air Ducts and Apparatus **- Use Stic-Klips**



- Stic-Klips become an integral part of Air Duct
- Stic-Klips hold insulation mechanically in compression.
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CHROMALOX Unit Heaters quickly and economically give needed warmth wherever heat is required. Air is forced across CHROMALOX Finstrip elements by a quiet fan and directed into the desired areas by adjustable louvers. High velocity discharge assures adequate supply of heated air. Units are available with manual or automatic controls in 1.5 to 15 KW. capacities.

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CHROMALOX SB-15

ELECTRIC HEATING AT ITS BEST!

ment and advises bidders on how to obtain information relative to products or services they have to offer. Another section deals with common errors in bidding and another section offers a number of helpful hints to bidders. Information is given on how to bid on specification items, how to figure discounts and liquidated damages, how to qualify bids without being disqualified, how to bid on all items without running the risk of a "single item award", and how to prequalify products.

Preformed and Packaged Ductwork

HPAC 120—Prepared by P. B. Patton, vice president, a 50 page manual on sizing and estimating "Flat-Pak" preformed and packaged ductwork is available from Viking Mfg. Corp., 1747 Chester Ave., Cleveland 14. By means of tables, some illustrated, the manual shows costs, equivalent lengths and material needed for practically every variation of standard ductwork, except for the length of branch or trunk which can be scaled from blueprints of the house or can be measured. Once the factor of length has been established, data for ductwork which meets the recommendations of the National Warm Air Heating and Air Conditioning Association can be found in the tables. The company's aluminum ductwork is preformed in standard sizes and shapes of fittings, including the necessary flanges, seams, notches, etc. but it is not assembled. Fittings are shipped knocked-down and nested 10 to a carton or may be ordered packed for any of the branch and combinations illustrated in the manual.

Recording Gages

HPAC 121—Bristol Co., Waterbury 20, Conn., has published a 32 page bulletin on its series 500 line of recording gages. Information is given on pressure gages for ranges from 0 to 2 in. of water to 0 to 10,000 psi per sq in., vacuum gages, low range draft and pressure gages, barometers and absolute pressure gages for ranges as low as 0 to 6 mm of mercury, absolute. Measuring elements, operating principles, recording charts and accessories for the various types of recording gages are described.

Remote Liquid Level Indicators

HPAC 122—A 20 page bulletin (WG-1823) describes remote liquid level indicators for boilers, heaters, storage tanks and other vessels in power and industrial process plants. Auxiliaries covered include automatic control units for operation of distantly located alarm signal lights, signal horns, and electric switches. Offered by Yarnall-Waring Co., Mermaid Lane, Philadelphia 18, the bulletin contains detailed information.

Speed Control

HPAC 123—The automatic "Vari-Pitch" drive, a method of speed control designed for most speed changing needs from 1-½ to 40 hp, is described in a new 12 page bulletin (20B7223A) released by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. To increase the speed, the motor is moved toward the driven sheave. Moving the motor away decreases the speed. Belt tension is automatically maintained and a speed variation of approximately 2 to 1 is possible.

Steam and Air Traps

HPAC 124—Steam and air traps for pressures up to 600 psi are covered in a new bulletin issued by C. E.

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MODULATION DIAL SHOWS SQ. FT. E.D.R.
NOISELESS

RADIATOR SUPPLY VALVES

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Quick
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The Type H Orifice Valve is instantly adjustable and shows the EDR setting at a glance. No dis-assembly necessary. Steam or Hot Water service.

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Here's another typical money-saving fastening triumph for DRIVE-IT—fastening seat brackets at the Grand Rapids Speedrome.

Wherever steel or wood must be fastened to concrete, steel or other hard materials there's a spot for DRIVE-IT to save you money. Reports of 75% to 85% savings over old-fashioned methods are common. With Drive-It, a drive-pin plus a power charge does the job in a split-second—and *better* than the old "dig and drill" method.

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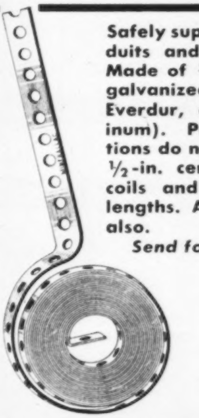
Perforated
STRAP
Versatile Hanger Iron



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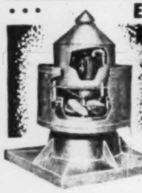

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THE AUER REGISTER COMPANY
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". . . did YOU make a note about the message on page 189?"

Squires Co., 18502 Syracuse Ave., Cleveland 10. Capacity tables and sizing information are given, together with data on the company's automatic air release for blast trap service, the double valve mechanism, and the new "Venturo-Valve".

Steel Valves

HPAC 125—The Vol. 10, No. 35 issue of the house organ published by Edward Valves, Inc., East Chicago, Ind., contains a pressure-temperature rating table for steel valves, pipe flanges and flanged fittings conforming to the ASA standard B16e6-1949. The feature article, by E. B. Pool, company research engineer, deals with testing techniques in connection with valve design. Also included is a description of the company's new laboratory for steel valve research.

Unit Heaters

HPAC 126—Catalog No. 575 has been prepared by National Radiator Co., Johnstown, Pa., and illustrates and describes its new line of unit heaters for horizontal or down flow delivery of air. Recommendations are given in regard to selecting the sizes and type of heaters, and data are given on mounting heights and the floor spread diameter of air in down flow units. According to the company, all models can be used on either steam or hot water heating systems.

Variable Speed Drives

HPAC 127—The PIV variable speed drives of Link-Belt Co., 307 N. Michigan Ave., Chicago 1, are available in eight sizes and 16 types, in horsepowers of ½ to 25, and with manual and automatic controls. They are described and illustrated in a new 88 page booklet (No. 2271). A special feature of the booklet is said to be the convenience with which a drive of the right specification for a specific service may be selected directly from 36 pages of preselected drives.

Variable Speed Motors

HPAC 128—The "Varidrive" motors of U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54, are all-in-one power drive units designed to perform the work of a motor, speed changer, cone pulleys, rheostat or controller and gear box. A new bulletin covers 15 features of the recently developed line of fractional horsepower units. Featuring the VA series, the bulletin illustrates several modifications of the design, including three phase and single phase, combination gear drives, and types with flanged brackets for direct connection to the driven machine.

Working Seamless Tubes, Pipe

HPAC 129—Bulletin 9B is the latest edition of the reference handbook on methods of working seamless tubes and pipe of the intermediate "Croloys" (ferritic air hardening alloys containing ½ to 9 per cent chromium) offered by Babcock & Wilcox Tube Co., Beaver Falls, Pa. It incorporates new data accumulated since 1946, the publication date of the previous issue. Arranged as a pocket size book, it presents information on composition, general characteristics, annealing practice, methods of hot and cold working, and welding, together with condensed technical data and general reference tables.

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FOR SALE — One used No. 6½ SI-SW-CW-BHD Series 30 American Blower Sirocco fan with V-belt drive and 5 HP 220 volt 3 phase 1200 RPM motor and sliding base; unit capable of producing 15,000 CFM. Price $585 net FOB Bluefield. We also have 150-foot duct at low price. Bluefield Supply Company, Bluefield, W. Va.

wanted

WANTED: Engineer Familiar with Gas-Fired Unit Heater design. Address Key No. 880-A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2.

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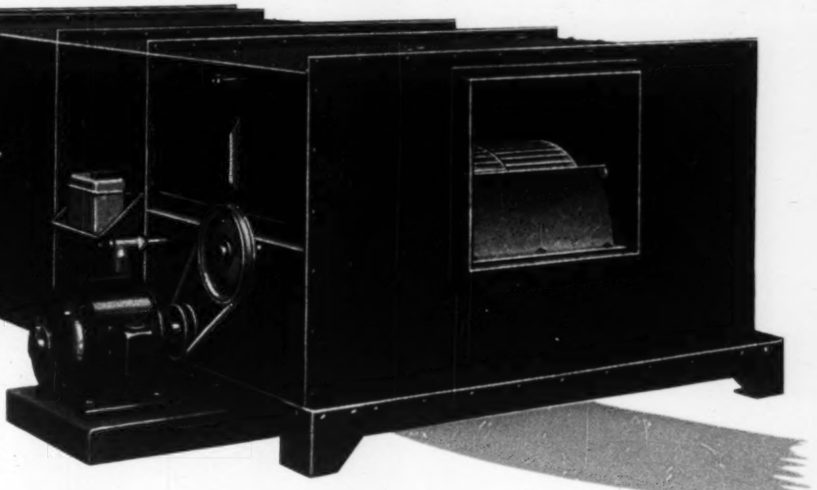
AIR CONDITION!



* Units can be also furnished for heating only, or cooling only — very flexible equipment. Every Multitherm is factory tested for performance.

MULTITHERMS—WHOLE "WORKS" IN ONE ASSEMBLY . . . BUILT FOR ALL SORTS OF INDUSTRIAL AND COMMERCIAL APPLICATIONS

The Clarage Multitherm unit shown above is a complete conditioning plant* . . . (1) it *cleans* the air, removing bacteria, pollen and dust . . . (2) it *cools and dehumidifies* in summer utilizing cold well water, brine or a direct expansion refrigerant . . . (3) it *heats and humidifies* in winter using steam or hot water . . . (4) it supplies at all times a circulation of conditioned air under positive fan pressure.

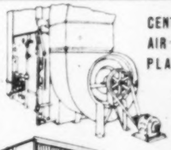
Multitherms are as easy and inexpensive to install as unit heaters — and just as satisfactory in operation. They may be suspended from the ceiling, mounted on platforms, or installed on the floor. Sizes range from 400 to 13,600 c.f.m. If the job is extra large, it can be handled with two or more units.

Look into Clarage Multitherms if you have any type of air conditioning problem. They are engineered to give precision results — compact to save space — of heavy duty construction for years of continuous trouble-free service. *And, as compared to central station conditioning, you can usually save considerable money.*

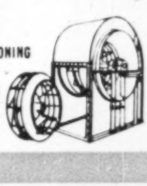
Write us, outlining your requirements — or ask for Bulletin 107 giving complete information.

SOME OF OUR OTHER PRODUCTS

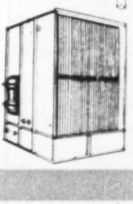
UNIT HEATERS



CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



AIR WASHERS

CLARAGE

FAN COMPANY

Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Sam, you better SCRAM!

This shouldn't even happen to Sam—

Lower end of water glass showing paper-thin wall where break occured.

Top of same water glass showing original wall thickness.

We thought we knew every reason for Sam to scram—every condition that can cause low water in a heating boiler. But there's always a new one, and here's one of the strangest yet:

The owner of a large residence near Chicago returned home after a short absence to find his burner stopped and his boiler room floor wet. A search for the cause revealed the water glass broken through just above the lower packing nut, permitting the water to drain out of the boiler down to that point.

Closer examination showed that years of washing action had actually worn the glass paper-thin until it finally broke through at the lower end. The two photos show exactly what happened. Fortunately there was a McDonnell Low Water Cut-off on the job to stop the burner before the water level dropped into the danger zone.

So there you have another proof that no one can forsee when low water will occur. Since the owner can't prevent low water, every boiler should be protected (as this one was) with a dependable McDonnell water level control to forestall the trouble.

How many boilers in your community still need this protection that means safety for the boiler owner and profit for you?

Ask for latest condensed catalog and price list.

McDONNELL & MILLER, INC.

3500 N. Spaulding Ave., Chicago 18, Ill.

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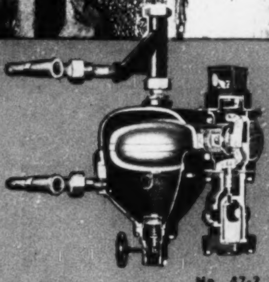
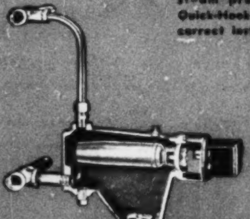
Doing One SAFETY *Thing Well*

Your Jobber Stocks Them



No. 47-2 Feeder-Cut-off Combination for boilers below 5000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.



No. 67 Low Water Cut-off for all automatically fired boilers; maximum steam pressure, 20 lbs.

No. 150 Water Level Control for boilers of any size with steam pressures up to 150 lbs. Used as feed-pump control; low-water fuel cut-off; low water alarm switch, or any combination of these functions.

McDONNELL

Boiler Water Level Controls